ELECTRICAL REVIEW

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IN THIS ISSUE

Signs of Revival	**611**
Large Electrode Furnace	**613**
Electrical Engineers' Exhibition	**616**
High-Temperature Steels	**618**
Chalk Crushing and Screening	**619**
Magnetic Invertors	**620**
Determinants—1. By E. H. Sibley, B.Sc.(Eng.) Hons.	**621**
Industry and the House. By A. M. F. Palmer, A.M.I.E.E., M.P.	**625**
Personal and Social	**629**
Views on the News	**634**
Electrical Research	**635**
Correspondence	**637**
Cable Spiking	**639**
Commerce and Industry	**641**
Modern Furniture Manufacture	**647**
Electricity Supply	**649**
Recent Introductions	**651**
Highland Water Power	**653**
European Power	**656**
Financial Section	**657**
Next Week's Events	**660**
New Patents	**661**
Contract Information	**663**
Classified Advertisements	**135**
Index to Advertisers	**150**

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ELECTRICAL REVIEW 20th MARCH, 1953

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872 • VOL. CLII • NO. 12

Signs of Revival

A FORTNIGHT ago we drew attention to the low state into which the electric cooking load had fallen because of the subtle anti-electric campaign which has now been proceeding for some years. We called upon the industry to break the chains which have bound it ever since it was found that demand and plant capacity were out of balance. The cooker load was specifically referred to because it is probably the most important domestic aspect, but the arguments in its favour apply also to other uses of electricity in the home.

Since we wrote we seem to have sensed the beginnings of a resurgence. Maybe it is the nearing of spring, which perennially raises human hopes, but more probably it is the stirring of electrical minds which remember the days when the industry was younger and saw limitless possibilities. These possibilities remain and the onward march must be resumed. It is commonly said that only the surface has been scratched. In the last few years an overburden has accumulated upon the surface and our first task is to clear it away. In other words, the public mind has to be freed from the idea that the use of electricity is in some way detrimental to the country's interests when actually the reverse is the truth. The case for electricity is as strong as it was in the days when electrification was recognized to be synonymous with social progress.

But before the public can be effectively dealt with it will be necessary to educate our own people. Many of the younger ones upon whom much of the work will fall have never known real electrical freedom. Fear of the peaks has restrained them from really selling electricity and in this way "exalting the valleys." They have not had the advantage of the active assistance of the British Electrical Development Association which itself has been forced to adopt a caution alien to its nature and has been able merely to keep its propaganda machine "ticking over." Now the time has come for "revving up" and we believe that E.D.A. is

ready. First it has to educate the electricity supply people themselves and it is already moving in this direction. Next week a Demonstrators' Conference is being held and in May there is to be a revival of the Sales and Service Conferences which formerly provided a potent stimulus to the commercial staffs of the supply industry. Properly equipped and backed by effective publicity by E.D.A. and the Electricity Boards, these " evangelists " will restore electricity to the esteem in which it was formerly held by the public.

INTERNATIONAL STANDARDS

Besides acting as a co-ordinating body which furnishes the machinery whereby voluntary standards can be agreed between manufacturers and users, the British Standards Institution becomes of increasing importance internationally. Its director and secretary, Mr. H. A. R. Binney, at the Royal Society of Arts on Wednesday stressed the need to maintain the position that conformity with a British Standard guaranteed ability to meet foreign purchasers' requirements. This reputation materially helped this country to become the world's greatest exporter of electrical goods in 1938 and to double the quantity sent abroad in 1948. The electrical industry, with upwards of 350 B.S. forming 24 per cent of the whole, is the largest contributor to standardization. It is therefore especially concerned to ensure that the setting up of national standards in other countries shall not form a barrier to export.

SIMULTANEOUS EQUATIONS

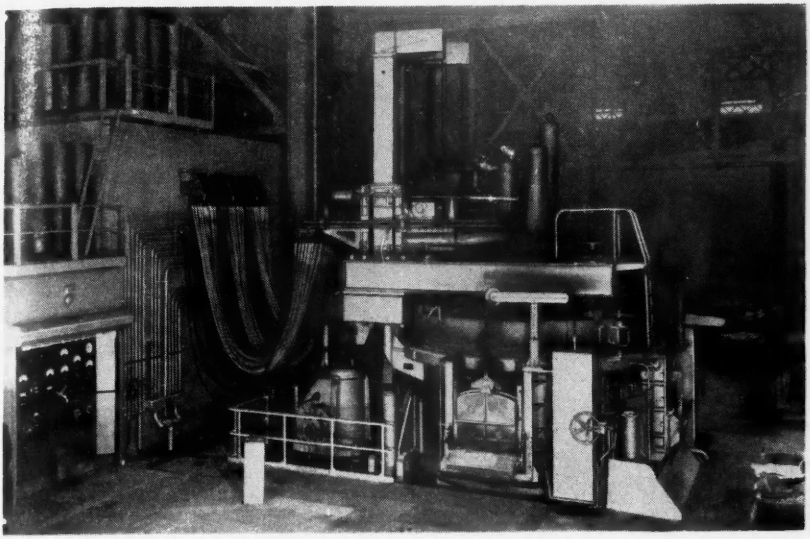
Many of the problems which the electrical engineer encounters in the course of his work involve simultaneous equations. In some cases solution is not difficult but in others, where there are many unknown quantities, as in distribution, bridge and similar networks, the conventional algebraic method entails much labour. It also involves much time and often the wrong answer. If determinants are used, however, the problem is reduced to simple arithmetic, but unfortunately this branch of mathematics is often disregarded, particularly by electrical engineers. For this reason we are publishing a two-part article by Mr. E. H. Sibley in which he shows how simple determinants really are and in the process he dispels much of the " mystery " surrounding the subject. This week he explains what a determinant is, how it is written down, and how it can be contracted and simplified. In the second article he will deal with its use in the solution of equations, with particular reference to network analysis.

SCOTTISH WATER POWER

Against the admittedly high cost of the water power developments being carried through by the North of Scotland Hydro-Electric Board must be set the substantial benefits which are accruing to the Highlands and nationally. Already the output is equivalent to an annual saving of 600,000 tons of coal and in its evidence to the Ridley Committee the Board showed that by 1958–60 the figure is likely to reach 2,000,000 tons. An essential part of this programme is the Breadalbane scheme in Perthshire debated in the House of Commons last week.

INTER-DOMINION TRADE

In December last we published a request by a Vancouver, B.C., firm for offers from makers of small generators and a number of replies were received. It is indicative of the interest taken in the *Electrical Review* in Australia, as well as the possibilities envisaged by Australian manufacturers, that we have been asked for the inquirer's name by an electrical manufacturing concern in Sydney, New South Wales. Our note was meant to help Home manufacturers but we must not complain if the Dominions wish to take a hand.



Large Electrode Furnace

Twenty Ton Swinging Roof Plant at Sheffield Steelworks

THE first pouring recently of a 20 ton Birlec "Lectromelt" arc melting furnace marked an important stage in the major foundry development plans which were begun in 1947 at the East Hecla Works, Sheffield, of Hadfields, Ltd.

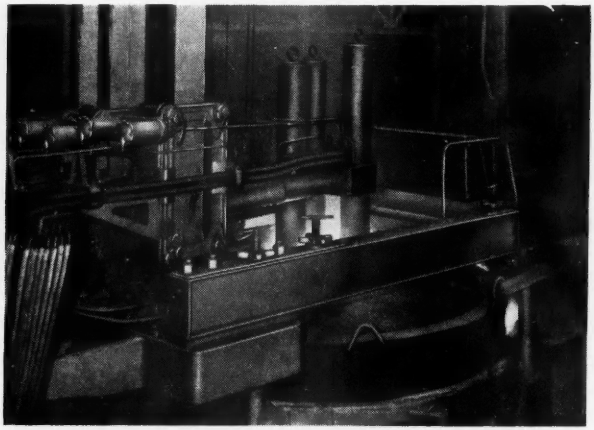
The installation of this furnace involved the erection of a complete melting shop, including two 40 ton electric overhead gantry cranes with 10 ton auxiliary hoists, an 18ft 10in deep pouring pit, an ingot casting pit, a pit to contain the scrap charging bucket, and the necessary housing for the extensive electrical equipment.

This furnace, which is to be used for the production of high quality steels and is to be normally operated continuously, is situated between two of the shop bays, the crane system in one bay serving the furnace charging operations while that in the other bay handles the ladle during pouring and casting.

Conforming generally with the established characteristics of direct arc furnace design, the new furnace is based on the designs of the American Pittsburgh Lectromelt Corporation and is distinguished by extreme sturdiness of construction. The dished-bottom cylindrical shell is about 14ft in diameter and it provides a large slag contact area. It is constructed of heavy gauge steel plates reinforced with structural steel members and, to prevent distortion of the shell under heat, a heavy top stiffening water cooled bezel ring is provided. The wall of the shell is lined with metal-cased magnesite cylindrical bricks; the hearth is dolomite.

There are two portals in the shell, one opposite the pouring spout and the other at 90 deg to this opposite the electrode masts, the former being used during slagging, oxygen lancing, fettling and like

The electrodes of this 20 ton Birlec "Lectromelt" arc furnace are amplidyne controlled



The roof structure swings through almost 90 deg to expose the hearth ready for top charging

operations, while the latter serves for adding alloy materials to the charge. The portals are provided with pneumatically operated vertical sliding doors. The doors and the robust pouring spout are designed for easy refractory lining.

There are two water-cooled roof rings of heavy, channel section steel and of larger diameter than the furnace shell, so as to ensure that the skew-back bricks are away from the greater heat of the molten metal, consequently greatly increasing their life. This is believed to be the first case in which "four-point roof suspension" has been adopted for a British arc furnace of so large a capacity as 20 tons; this design greatly facilitates roof change as the new roof can be quickly located by the four holding screws without difficulty in aligning the electrode ports with the electrodes. The most notable design feature of this furnace is the lift and swing-aside roof and its method of operation which enables the complete hearth to be exposed for reloading or fettling. The suspended roof has a massive eye-casting, itself weighing over 10 tons, which engages a hydraulically operated vertical ram, the cylinder of which is mounted entirely separately from the furnace body, so that the furnace shell is not subjected to severe stresses when the roof is lifted.

The roof is raised from the shell by the engagement of the ram with the eye-casting, and the complete roof structure is then swung round through almost 90 deg to expose the hearth ready for top charging. The drop bottom bucket is then lowered into the shell to effect charging. The roof lifting and swinging mechanisms are interlocked to ensure correct sequence of operation and to prevent the tilting of the furnace except when the roof is in the working position. The furnace is tilted by steel rocker trunnions which engage with horizontal tracks on either side of the shell. The total weight of the tilting gear exceeds 12 tons. There is no mechanism under the shell, and the furnace will tilt forward 45 deg for pouring and to a lesser extent backwards for slagging. The tilting rockers are operated by a pair of oil-pressure rams mounted one each side of the furnace, the oil pressure being supplied by a self-contained motor pump unit which also serves the roof lifting mechanism.

The furnace is fitted with three 14in diameter British Acheson graphite electrodes, which are held in high conductivity copper clamps and project vertically through the furnace roof. The copper clamps are water cooled, and a special feature of the clamps is their pneumatic operation under remote control, thus facilitating electrode changing and adjustment. The clamps are mounted on the extremities of horizontal arms which also carry the electricity conductors and the cooling water tubes to the clamps.

The arms are designed to minimize eddy currents and are connected to the vertical masts by crossheads, which are fitted with hardened steel adjustable rollers in anti-friction bearings which engage with flat machined surfaces on the masts to ensure smooth up-and-down movement without lateral play. The electrical masts are mounted at the rear of the furnace shell on the heavy steel eye-casting which also carries the roof supporting beams.

The electrode carriages are suspended on flexible steel cables passing over

ball-bearing sheaves, and they lead through ducts in the furnace foundations to individual winches placed beneath the melting shop floor. The winches are gear driven by d.c. motors rated for frequent reversing duty, and the winch drums are provided with specially designed friction bands over which the suspension cables are taken to terminate in counterweights. Electrode control by the direct current amplifier control system is a highlight of the installation, the equipment including B.T.H. amplidyne regulators.

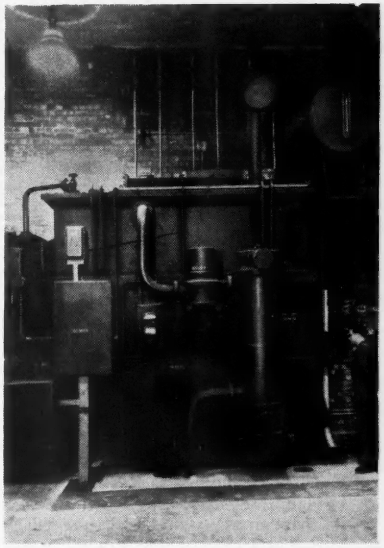
The field excitation of the amplidyne generator is controlled from opposed voltage and current components of the furnace power circuit and produces instantly a corresponding but greatly magnified variation in the generator voltage applied to the winch motors. Thus the winch motors are energized in proportion to the degree of out-of-balance in the furnace power circuit, and the electrodes move rapidly to compensate for large changes, and proportionately more slowly for small variations. The system thus provides high-speed, smooth, stepless movement of the electrodes, with high sensitivity and accuracy of control.

A 6,000 kVA 11·2 kV Parsons transformer is the main source of electricity supply to the furnace, and it has eight secondary tappings by which on-load tap changing is effected by either motor operation with push-button control or manual control. An illuminated indicator on the furnace instrument panel shows the position of the tapping switch at all times.

The transformer is constructed with specially-braced windings to withstand heavy current fluctuations, and is conservatively rated to limit its temperature rise to 50 deg C, measured in the oil, under continuous full load. The water cooling system is equipped with a temperature alarm device to warn the operator immediately in the event of an unsafe oil temperature.

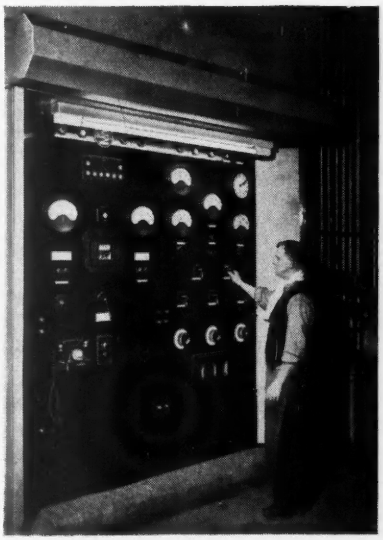
The Reyrolle main circuit breaker is a solenoid operated metalclad 400 A compound-filled single busbar switch panel equipment with a rupturing capacity of 150 MVA at 11 kV. An interlocking relay ensures that the breaker trips whenever the transformer tap change switch operates or when any of the individual furnace interlocks make contact.

All the controls and metering equipment are centralized in one black " Sindanyo "



A 6,000 kVA 11·2 kV transformer is the main electricity supply source for the furnace

The main control and metering board is readily accessible from the furnace surround



control board which is mounted in the wall of the transformer substation and is easily accessible from the environs of the furnace. It contains the necessary indicating lamps for electrode voltage and auxiliary electricity supplies, the transformer tapping switch indicator, an electric clock, voltmeter and multi-point switch for electrode voltages, an ammeter for each electrode circuit, and a kW meter to show the power applied to the furnace: it also carries the required control switches for the electrode winch motors, hand operated rheostats for obtaining the correct arcing conditions and isolators for the auxiliary a.c. and d.c. supplies for instrument operation, etc. A telephone on the board connects to the main Hadfields switchboard.

Electrical Engineers' Exhibition

Next Week's Display at Earls Court

OVER a hundred electrical manufacturers, associations and others are participating in the Electrical Engineers' Exhibition which the Association of Supervising Electrical Engineers is holding at Earls Court, London, from Wednesday to Saturday next week (25th–28th March). The official opening will be performed at noon on Wednesday at the A.S.E.E. stand by Sir John Hacking, deputy chairman (operation) of the British Electricity Authority, who will be received by the Association's president, Mr. C. T. Melling, and the chairman, Mr. C. C. Emmett.

Two special features have been arranged. "Commercial Cooker Avenue" represents the latest designs and ideas of many manufacturers, while "Illumination Way" consists of three lines of illuminated fittings, each 200ft long with five of eleven manufacturers' fittings at every 10ft. The fittings range from tungsten-lamp reflector units to multi-fluorescent lamps and unit-neon lighting fittings.

Much new equipment is shown for the first time and among especially interesting items are switches using nylon insulation, a new type of domestic bell, a universal a.c./d.c. switch, shallow switches for flush mounting, a conversion unit for fluorescent fittings, aluminium-sheathed cables, a complete new range of floodlights, models of the 275 kV grid system and equipment for future development to 380 kV, electric furnaces for up to 1,750 deg C, pneumatic cable tubing methods, multi-pole contactors, busbar trunking, h.r.c. fuses up to 800 A, modern feeder pillars, flashers for pedestrian crossings, feed rails for trolleys and portable appliances, a grid suspension wiring system, wind power generating equipment, horticultural apparatus, timing units and counters, new tinted glass correction filament lamp fittings, heating mats, flameproof apparatus, hoseproof mercury hospital switches, electronic metal detection and photo-electric control apparatus, relays and process timers, capacitors, variable heat control socket outlets, a miniature lamp dimming unit, miniature circuit breakers, new test instruments and maintenance equipment. A stand-by-stand review of exhibits will be published in next week's issue.

The Electrical Association for Women has agreed to assist the Association's Technical Committee to judge the entries for a Domestic Labour Saving Award, and an Industrial Labour Saving Award is also to be made. The awards will take the form of silver engraved plaques mounted on ebony, with the Association's emblem book.

The *Electrical Review* will be pleased to answer questions on matters concerning the electrical industry at its stand (No. 103; telephone: Fulham 2391) near the Warwick Road entrance.

A list of manufacturers and associations which are taking part in the Exhibition appears on the facing page.

Exhibitor	Stand No.
Agro Electrical Co., Ltd.	14
Aidas Electric, Ltd.	2
A & M Electrical Services	27
Ashley Accessories, Ltd.	70
Association of Supervising Electrical Engineers	86
Automatic Coil Winder & Electrical Equipment Co., Ltd.	102
Barlow-Whitney, Ltd.	15
Bell Bros. & Co. (London), Ltd.	34
Benjamin Electric, Ltd.	58
S. O. Bowker, Ltd.	67
British Electrical & Allied Industries Research Association	94
British Electrical & Allied Manufacturers' Association	86B
British Electrical Development Association	93
British Electrical Repairs, Ltd.	96
British Electricity Authority	77
British Insulated Callender's Cables, Ltd.	52
British Iron and Steel Federation	1
British Thomson-Houston Co., Ltd.	91
Britmac Electrical Co., Ltd.	104
Browning's Electric Co., Ltd.	72
R. M. Catterson-Smith, Ltd.	28
Chilton Electric Products, Ltd.	97
City Engineering Co. (Boreham Wood), Ltd.	3
Clang, Ltd.	46
E. K. Cole, Ltd.	23
J. A. Crabtree & Co., Ltd.	29
Crompton Parkinson, Ltd.	61
Davis Sheet Metal Engineering Co., Ltd.	38
Delco-Remy-Hyatt (Division of General Motors), Ltd.	103
G. P. Dennis, Ltd.	100
Dimplex, Ltd.	24
Donovan Electrical Co., Ltd.	39
Dorman & Smith, Ltd.	57
Ductube Co., Ltd.	22
Edison Swan Electric Co., Ltd.	66
Electric Construction Co., Ltd.	40
Electric Lamp Manufacturers' Association	9, 12, 13 and 47
Electrical Industries Benevolent Association	86A
Electro-Mechanical Supplies, Ltd.	21
Electrothermal Engineering, Ltd.	37
George Ellison & Co., Ltd.	49
Enfield Cables, Ltd.	65
Engel & Gibbs, Ltd.	4
Falk, Stadelmann & Co., Ltd.	50
General Electric Co., Ltd.	76
Gillott Electro-Steam Cookers, Ltd.	71
G.M. Engineering (Ottery St. Mary), Ltd.	19
Gresham Transformers, Ltd.	11
Gulf Oil (Gt. Britain), Ltd.	90

Exhibitor	Stand No.
Hall Telephone Accessories, Ltd.	26
Hedin, Ltd.	41
W. T. Henley's Telegraph Works Co., Ltd.	62
Hirst Electronic Development, Ltd.	78
Holophane, Ltd.	30
A. H. Hunt (Capacitors), Ltd.	32
Ionlite, Ltd.	5
Isopad, Ltd.	33
Jeary Electrical Co., Ltd.	43
Johnson & Phillips, Ltd.	51
Lancashire Dynamo Group	6
Loma Electronic Equipment, Ltd.	17
Londex, Ltd.	18
Mantel Metalworkers, Ltd.	99
Martindale Electric Co., Ltd.	36
Measuring Instruments (Pullin), Ltd.	35A
Millett Levens (Engravers), Ltd.	88
M.K. Electric, Ltd.	89
Nettle Accessories, Ltd.	74
New Day Electrical Accessories, Ltd.	71
Newman Industries, Ltd.	45
Partridge Transformers, Ltd.	8
Philips Electrical, Ltd.	63
Pyrotenax, Ltd.	25
Ranton & Co., Ltd.	44
Rawlplug Co., Ltd.	79
Revo Electric Co., Ltd.	54
Wm. Sanders (Wednesbury), Ltd.	31
Santon, Ltd.	56
G. H. Scholes & Co., Ltd.	16
Service Electric Co., Ltd.	64
Siemens Electric Lamps & Supplies, Ltd.	83
Simplex Electric Co., Ltd.	95
Standard Telephones & Cables, Ltd.	107
Strand Electric & Engineering Co., Ltd.	98
Sunvic Controls, Ltd.	87
Synthetic Carbon & Engineering Co., Ltd.	81
Taylor Electrical Instruments, Ltd.	68
Telegraph Construction & Maintenance Co., Ltd.	10
Telephone Manufacturing Co., Ltd.	60
Thorn Electrical Industries, Ltd.	42
T.M.C.–Harwell (Sales), Ltd.	20
Troughton & Young, Ltd.	53
J. H. Tucker & Co., Ltd.	69
Tudor Accumulator Co., Ltd.	84
Varilectric, Ltd.	85
Venner, Ltd.	73
W. G. Walker & Co. (Engineers), Ltd.	7
Walsall Conduits, Ltd.	75
Wandsworth Electrical Mfg. Co., Ltd.	59
Watford Electric & Mfg. Co., Ltd.	55
Westinghouse Brake & Signal Co., Ltd.	82
Henry Wiggin & Co., Ltd.	80

High-Temperature Steels

Steam Power Plant Requirements

THE research work carried out by the Steels for High Temperature Committee of the Electrical Research Association between 1930 and 1952 was reviewed in a paper discussed last Friday at the Institution of Mechanical Engineers in London.

The review was compiled by Mr. A. M. Sage (technical secretary, Metallurgy Division, British Iron and Steel Research Association) who, though he has not been concerned with the actual experimental work, has had access to all reports on and papers connected with this research work. The value of the contributions of numerous investigators at the National Physical Laboratory since the inception of this work was acknowledged in the paper, which pointed out that study of creep properties led to the adoption of chromium-molybdenum and chromium-molybdenum-silicon and, to a lesser extent, molybdenum-vanadium steel for making such plant components as superheater tubes, steam pipes and superheater headers for operation at temperatures above 900 deg F.

Creep Tests

From creep tests made, the stress-time relation for each component was obtained; methods of creep testing were compared and abnormally high rates of creep were investigated. The paper described the testing of the reliability of long-time creep tests derived from short-time creep tests and how a mathematical relation was derived between relaxation time and stress.

The effects on the properties of the steel of the presence of minor elements in it and of the method of its manufacture were described; also the cause and effects of grain growth, while the causes of and means of avoiding the cracking of steel had been studied.

Power station efficiency had been improved considerably in the last quarter century by raising steam temperature from 700 to 950 deg F and pressure from 500 to 1,000 lb/sq in. Further elevations of both were anticipated, which would necessitate the use of steel that was more resistant to creep at high temperatures than were those varieties at present available. Some of the steels employed (based on short-time test data) for making the high-temperature components of aircraft gas turbines were being considered for certain power station components required to withstand steam temperatures of about 1,050 deg F and one steel—the 18/12/1 austenitic—had been adopted for steam pipes and superheater tubes in two or three experimental stations in Britain. The $2\frac{1}{4}$ per cent chromium–1 per cent molybdenum ferritic steel developed in the United States and used in some high-temperature steam power plants had been adopted for other development plants in Britain. Tests were in hand (a year ago) to obtain design data on the basis of long-time creep tests carried out on specimens machined from both steam pipes and superheater tubes of each of these two steels. Similar tests were also in hand on specimens from steam pipes of molybdenum-vanadium steel which also was to be used for certain steam pipes in plants, operating under similar conditions, which were being made for export.

Alloy steels were also being developed to withstand the greater stresses in bolts of the turbine casings, while the modes of corrosion and scaling of steels in contact with superheated steam and with flue gases were also being studied. The two last-mentioned subjects were becoming almost as important as creep under the more severe operating conditions contemplated.

I.E.E. Western Centre

THE summer meeting of the Western Centre of the Institution of Electrical Engineers will be held from 15th to 18th May at Woolacombe Bay Hotel, North Devon. Applications for reservations should be made by 27th March to Mr. A. H. McQueen, hon. assistant secretary, 15, Great George Street, Park Street, Bristol, 1.

Chalk Crushing and Screening

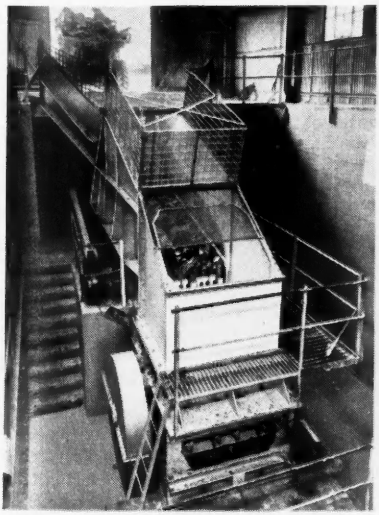
New Installation at the Chinnor Cement Works

NOW in full operation at the chalk quarries of the Chinnor Cement & Lime Co., Ltd., which have been worked since early in the present century, is a new crushing and screening plant all designed and manufactured by the Fraser and Chalmers Engineering Works of the General Electric Co., Ltd. The plant is capable of handling 70 tons of dry material per hour, containing pieces of chalk often larger than 36in by 24in by 24in.

The chalk is excavated at the quarry face by a 1 cu yd mechanical shovel and loaded into 5-ton dumpers running between the face and the crushing plant on a concrete road. The chalk is tipped into a steel receiving hopper, 12ft long by 5ft wide and 7ft deep, from which it is fed into the crusher by means of a moving-bar grizzly feeder which is particularly suitable for handling sticky material containing large pieces. This feeder removes the fines ahead of the crusher, which fall on to the belt conveyor below, and it is driven by a 7½ h.p. variable speed (480/725 r.p.m.) slip-ring motor, power transmission being through V-rope, spur gear and eccentrics.

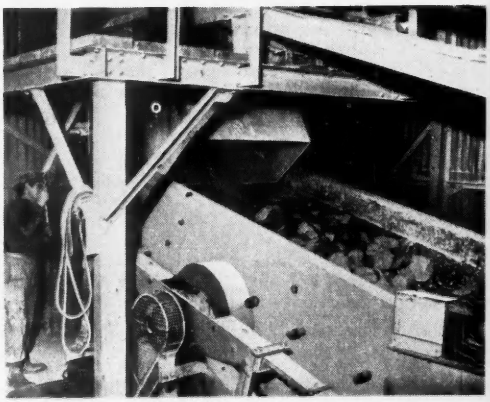
The Pennsylvania single-roll crusher is fitted with a manganese steel toothed roll which can be adjusted to vary the reduction in the size of the chalk to afford a product size range from minus 9in to minus 5in. The roll speed is 35 r.p.m. and the crusher is driven by a 65 h.p. 725 r.p.m. motor which transmits by V-rope to the crusher countershaft which is geared to the main roll.

The product, together with the grizzly undersize, then passes along an inclined belt conveyor with 156ft centres to the screening section. This conveyor is fitted with three-pulley type troughing idlers having tapered roller bearings. The bearings at the feed end are heavily rubber-cushioned and spaced at not more than 2ft centres. The return idlers are also equipped with tapered roller bearings, while the head, tail and snub pulleys are supported



Left: **Five-ton dumpers tip into a receiving hopper from which the single-roll crusher is fed**

Below: **Material for the crusher is normally passed to a "Gyrex" screen which has a "flopper" valve for by-passing**



on roller bearings. A weighted type belt cleaner and a hold-back gear of the pawl and ratchet type are fitted. A 10 h.p. 720 r.p.m. high-torque squirrel-cage motor drives the conveyor through worm reduction gear coupled to the head pulley shaft.

All material is discharged from the conveyor on to a 60in wide by 102in long "Gyrex" screen from which the oversize is fed into one hopper while the undersize passes to another. A "flopper" valve enables the screen to be by-passed when necessary, all the material then going direct to the undersize hopper. The "Gyrex" screen is fitted with a 6in mesh which can be varied to suit requirements. The screen undersize passes to the adjoining wash mill of the cement plant, while the oversize is discharged by means of a chain feeder into 1 cu yd Decauville wagons, by which it is transported to the lime kilns. The 30in chain feeder is driven by a 2 h.p. 720 r.p.m. motor which transmits power through a variable speed reducing gear. The "Gyrex" screen has a large high-grade steel eccentric vibration shaft which is supported at its ends in heavy self-aligning double roller bearings bolted to the screen base. The heavy roller bearings are also fitted in a tubular casting which is rigidly fastened to the side plates of the live frame, so that the latter is given a circular motion of about double the size of that imparted to the shaft. The screen is driven by a 7½ h.p. 720 r.p.m. high torque s.c. motor, with primary V-rope transmission.

The discharge to the wash mill is regulated by means of a 30in diameter by 62in wide roll feeder driven by a 2½ h.p. variable-speed (480/725 r.p.m.) slip-ring motor. An auxiliary chute provides for all the material to be by-passed direct into the wagons if required.

A 5-ton double girder hand operated servicing travelling crane spans the crusher house interior.

THE MAGNETIC INVERTOR

IN a paper which was read at a Measurements Section meeting of the Institution of Electrical Engineers in London on 3rd March Dr. E. H. Frost-Smith (Elliott Brothers (London), Ltd.) explains that the magnetic invertor is a low-level magnetic amplifying device suitable for the input of multi-stage magnetic amplifiers requiring a high sensitivity. Its principle of operation, however, differs from the conventional magnetic amplifier in that the load current corresponds to the even-harmonic m.m.f.s which are present in any asymmetrically-excited iron-core system.

Dr. Frost-Smith shows that a capacitor in parallel with the load can increase the gain about 15 times, but this occurs at the expense of linearity for large input signals. The invertor can have power gains ranging up to about 1,000 with corresponding time-constants of about 1 sec when operating at 50 c/s, while the stability is well within 10^{-12} W. It is thus a valuable addition to measuring and control instruments, and its mode of operation forms an interesting comparison with the theory of the 100 per cent self-excited transductor.

The invertor has already been applied to a wide diversity of instruments and it is normally used as a sensitive first stage of an orthodox magnetic amplifier, but it is not generally suitable for an output stage. It has been applied successfully to problems involving the amplification of signals from thermocouples, barrier-layer photocells and strain gauges, where its high stability makes it more suitable than the transductor. Hemingway originally made use of the principle for the development of a street-lighting controller, and it has since been used by Atkinson for the temperature control of furnaces. It has also been used in the measurement of the rectified output from waveguides at low power levels, where a robust meter is desirable but a high-sensitivity instrument is required. Other applications include regulation of voltage and frequency, and as a first stage in servo amplifiers provided a high speed of response is not required.

The invertor is undoubtedly very much superior to the transductor at low power levels and although the time-constant is about four times that of the equivalent transductor, there are many instances, particularly in process control and measurement, where speed of response is less important than good zero stability. It is also possible to arrange a single invertor unit to give a balanced output.

DETERMINANTS

By E. H. SIBLEY, B.Sc.(Eng.) Hons.*

1.—*How to Use This Powerful Yet Simple Mathematical Tool*

IT is a pity that the average engineer does his best to steer clear of mathematics, because it provides him with his most useful set of tools. One of the most neglected of these is the determinant, yet to use it one only has to know how to add, subtract, multiply and divide. Furthermore, the processes involved are simple and easy to understand.

Whenever the engineer has to solve simultaneous equations, such as in distribution, bridge and similar networks, determinants cut down on both time and the amount of paper used in the calculations. This article, the first of two, explains how a determinant is written down, what it means, and how it can be contracted and simplified. The second article will deal with the use of determinants for the solution of equations with particular reference to electrical network problems.

The simplest form of determinant looks like this:—

$$\begin{vmatrix} e & f \\ h & i \end{vmatrix} \text{ which means } ei - hf \ldots\ldots\ldots \quad (1)$$

This seems rather a long-winded way of writing down a simple statement but:—

$$\begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} = (aei + bfg + cdh) - (gec + hfa + idb) \ldots \quad (2)$$

Obviously, this three line determinant is a very much contracted way of writing down a complicated expression. Now, if b = o and c = o then it can be seen that:—

$$\begin{vmatrix} a & o & o \\ d & e & f \\ g & h & i \end{vmatrix} = (aei + o + o) - (o + hfa + o)$$

$$= a(ei - hf) \ldots\ldots\ldots\ldots \quad (3)$$

This means that:—

$$a \times \begin{vmatrix} e & f \\ h & i \end{vmatrix} = \begin{vmatrix} a & o & o \\ x & e & f \\ y & h & i \end{vmatrix} \ldots\ldots\ldots\ldots \quad (4)$$

where x and y are any numbers whatsoever and do not enter into the solution.

Returning to the method of writing down in (1) draw in arrows pointing NE and SE as follows:—

$$\begin{vmatrix} e & f \\ \nearrow & \searrow \\ h & i \end{vmatrix}$$

When the arrow points downwards the product is positive and when it points upwards it is negative, giving as before + ei − hf.

In the case of the three line determinant in (2) rewrite the first two columns and multiply out, downwards positive and upwards negative as before:—

$$\begin{vmatrix} a & b & c & a & b \\ & \searrow & \searrow & \searrow & \\ d & e & f & d & e \\ & \searrow & \searrow & \searrow & \\ g & h & i & g & h \end{vmatrix}$$

Taking a numerical example:—

$$\begin{vmatrix} 2 & 3 & 4 \\ 5 & 6 & 7 \\ 8 & 9 & 10 \end{vmatrix} = (2.6.10. + 3.7.8. + 4.5.9.) - (8.6.4. + 9.7.2. + 10.5.3.) \quad (5)$$

$$= 468 - 468 = 0$$

This may seem to involve an inordinate amount of multiplication, but there are several important rules which can be used to simplify matters. These rules are not going to be proved, as the proof would be unnecessary, it being felt that the reader can prove them for himself by two separate calculations, or else accept them on the principle that the end justifies the means. At this juncture, however, it should be pointed out that four-line and higher order determinants must not be evaluated by the

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same method as is used in two- and three-line cases; the method will be discussed later. Furthermore, a determinant is always square; that is, it has as many rows as columns.

As has been shown in equations (3) and (4) the arithmetic is less involved when there are several "elements" which are zero. The simplest method of solution is therefore to arrange as many zeros in the determinant as possible. This can be managed by the following simple rule: Any determinant is unchanged if *any* line (or column) is added to, or subtracted from, any other line (or column), the original being unchanged. For example:—

$$\begin{array}{l} \qquad\quad x\ \ y\ \ z \\ a\ldots. \\ b\ldots. \\ c\ldots. \end{array}\begin{vmatrix} 2 & 3 & 4 \\ 5 & 6 & 7 \\ 8 & 10 & 9 \end{vmatrix} \begin{array}{l} = (2.6.9. + 3.7.8. + 4.5.10) \\ \quad -(8.6.4. + 10.7.2. + \\ \quad 9.5.3) \ldots. \quad (6) \\ = 476 - 467 = 9 \end{array}$$

Subtracting line (b) from line (c) and then column (x) from column (y) the determinant becomes:—

$$\begin{array}{l} \qquad x\ y\ z \\ a\ldots. \\ b\ldots. \\ c\ldots. \end{array}\begin{vmatrix} 2 & 3 & 4 \\ 5 & 6 & 7 \\ 3 & 4 & 2 \end{vmatrix} \quad \begin{array}{l} \qquad x\ y\ z \\ a\ldots. \\ b\ldots. \\ c\ldots. \end{array}\begin{vmatrix} 2 & 1 & 4 \\ 5 & 1 & 7 \\ 3 & 1 & 2 \end{vmatrix} \ldots. \quad (6a)$$

If, in determinant (6a) line (a) is subtracted from lines (b) and (c) in turn we get:—

$$\begin{vmatrix} 2 & 1 & 4 \\ 3 & 0 & 3 \\ 3 & 1 & 2 \end{vmatrix} = \begin{vmatrix} 2 & 1 & 4 \\ 3 & 0 & 3 \\ 1 & 0 & -2 \end{vmatrix} \ldots\ldots\ldots\ldots (6b)$$

This may be written down as:—

$$\begin{aligned} &(2.0.(-2) + 1.3.1. + 4.3.0.) \\ &\quad -(1.0.4. + 0.3.2. + (-2).3.1.) \\ &\quad = 3 + 6 = 9 \end{aligned}$$

It will be appreciated that the labour involved is considerably less if large numbers appear, particularly as it is impossible to use a slide-rule when accuracy is required. For instance, in the above example the answer is found by subtracting two three-figure numbers, the final answer being a single figure.

Solving equation (5) by this method gives:—

$$\begin{array}{l} \qquad x\ \ y\ \ z \\ a\ldots. \\ b\ldots. \\ c\ldots. \end{array}\begin{vmatrix} 2 & 3 & 4 \\ 5 & 6 & 7 \\ 8 & 9 & 10 \end{vmatrix}$$

Subtracting line (a) from line (b) and then line (a) from line (c) we get:—

$$\begin{vmatrix} 2 & 3 & 4 \\ 3 & 3 & 3 \\ 8 & 9 & 10 \end{vmatrix} = \begin{vmatrix} 2 & 3 & 4 \\ 3 & 3 & 3 \\ 6 & 6 & 6 \end{vmatrix} \begin{array}{l} \ldots.a \\ \ldots.b \\ \ldots.c \end{array}$$

then, subtracting line (b) twice from line (c) gives:—

$$\begin{vmatrix} 2 & 3 & 4 \\ 3 & 3 & 3 \\ 0 & 0 & 0 \end{vmatrix} = 0$$

The number of lines (or columns) of a determinant is referred to as its "order." Thus, equation (1) is a determinant of the second order, while equation (2) is of the third order.

It has already been stated that there is no way of writing down rapidly the answer to a four or higher order determinant. Generally, however, they can be simplified and reduced in order as will be shown later, but they can be quickly put into a set of lower order determinants thus:—

$$\begin{vmatrix} a & o & o \\ d & e & f \\ g & h & i \end{vmatrix}$$

This has already been shown, in equation (4), to simplify into:—

$$+ a \times \begin{vmatrix} e & f \\ h & i \end{vmatrix}$$

If we write down the answer to:—

$$\begin{vmatrix} o & b & o \\ d & e & f \\ g & h & i \end{vmatrix} \begin{array}{l} = (o + bfg + o) - (o + o + idb) \\ = b(fg - id) \\ = -b(id - fg) = -b(di - gf) \ldots (7) \end{array}$$

Rewriting this as a determinant we get:—

$$- b \times \begin{vmatrix} d & f \\ g & i \end{vmatrix}$$

Similarly, it can be shown that:—

$$\begin{vmatrix} o & e & c \\ d & e & f \\ g & h & i \end{vmatrix} = +c \times \begin{vmatrix} d & e \\ g & h \end{vmatrix} \quad \ldots\ldots\ldots\ldots (8)$$

This gives a general method for writing down the answer to:—

$$\begin{vmatrix} a & b & c & d \\ e & f & g & h \\ i & j & k & l \\ m & n & o & p \end{vmatrix}$$

which gives:—

$$+a\times\begin{vmatrix} f & g & h \\ j & k & l \\ n & o & p \end{vmatrix} - b\times\begin{vmatrix} e & g & h \\ i & k & l \\ m & o & p \end{vmatrix} + c\times\begin{vmatrix} e & f & h \\ i & j & l \\ m & n & p \end{vmatrix} - d\times\begin{vmatrix} e & f & g \\ i & j & k \\ m & n & o \end{vmatrix} \quad \ldots\ldots\ldots (9)$$

This really means that any line may be crossed out, for example, the third:—

$$\begin{vmatrix} a & b & c & d \\ e & f & g & h \\ \cancel{i} & \cancel{j} & \cancel{k} & \cancel{l} \\ m & n & o & p \end{vmatrix}$$

Then, taking the second term j, the second column may be crossed out, thus:—

$$\begin{vmatrix} a & \cancel{b} & c & d \\ e & \cancel{f} & g & h \\ \cancel{i} & \cancel{j} & \cancel{k} & \cancel{l} \\ m & \cancel{n} & o & p \end{vmatrix}$$

The three line determinant which is left is known as the minor of j:—

$$\begin{vmatrix} a & c & d \\ e & g & h \\ m & o & p \end{vmatrix}$$

To find out whether it is positive or negative, the following diagram is used:—

$$\begin{vmatrix} + & - & + & - & + & - & \ldots\ldots \\ - & + & - & + & - & + & \ldots\ldots \\ + & - & + & - & + & - & \ldots\ldots \\ - & + & - & + & - & + & \ldots\ldots \\ + & - & + & - & + & - & \ldots\ldots \end{vmatrix} \quad \ldots\ldots\ldots (10)$$

The result is that the minor of (j) needs a minus sign before it. Calling A the minor of (j) this gives the determinant

$$(\Delta) = iA_i - jA_j + kA_k - lA_l \ldots . (11)$$

When the engineer uses determinants he generally finds the solution much simpler due to the presence of many zeros. This will readily be appreciated when the final part of this article has been read. Furthermore, determinants of a higher order than the third are seldom needed.

It can be seen that if (j), (k) and (l) in equation (11) can be made zero, the whole fourth order determinant reduces immediately into a third order one. This may be done by using the simplification rule already explained. For example:—

$$\begin{array}{l} \\ a.... \\ b.... \\ c.... \\ d.... \end{array} \begin{array}{c} \begin{array}{cccc} w & x & y & z \end{array} \\ \begin{vmatrix} 1 & 5 & 2 & 1 \\ 0 & 4 & 2 & 3 \\ 3 & 2 & 1 & 2 \\ 3 & 4 & 2 & 5 \end{vmatrix} \end{array} = \Delta \quad \ldots\ldots\ldots (12)$$

Subtracting column (x) from (z) and also from (w) we get:—

$$\Delta = \begin{vmatrix} 1 & 5 & 2 & -4 \\ 0 & 4 & 2 & -1 \\ 3 & 2 & 1 & 0 \\ 3 & 4 & 2 & 1 \end{vmatrix} = \begin{vmatrix} -4 & 5 & 2 & -4 \\ -4 & 4 & 2 & -1 \\ +1 & 2 & 1 & 0 \\ -1 & 4 & 2 & 1 \end{vmatrix}$$

then by subtracting (w) from (y) and twice (w) from (x):—

$$\Delta = \begin{vmatrix} -4 & 5 & 6 & -4 \\ -4 & 4 & 6 & -1 \\ 1 & 2 & 0 & 0 \\ -1 & 4 & 3 & 1 \end{vmatrix} = \begin{vmatrix} -4 & 13 & 6 & -4 \\ -4 & 12 & 6 & -1 \\ \cancel{+} & \cancel{-} & \cancel{0} & \cancel{0} \\ - & 6 & 3 & 1 \end{vmatrix}$$

$$= +1 \times \begin{vmatrix} p & q & r \\ 13 & 6 & -4 \\ 12 & 6 & -1 \\ 6 & 3 & 1 \end{vmatrix} \begin{matrix} \\ \ldots . l \\ \ldots . m \\ \ldots . n \end{matrix}$$

If (n) is then added to (m) and 4 times (n) to (l):—

$$\Delta = \begin{vmatrix} 13 & 6 & -4 \\ 18 & 9 & 0 \\ 6 & 3 & 1 \end{vmatrix} = \begin{vmatrix} (13+24) & (6+12) & 0 \\ 18 & 9 & 0 \\ -6 & -3 & 1 \end{vmatrix}$$

$$= +1 \times \begin{vmatrix} 37 & 18 \\ 18 & 9 \end{vmatrix} \begin{matrix} \ldots . s \\ \ldots . t \end{matrix}$$

Finally, if twice (t) is subtracted from (s):—

$$\Delta = \begin{vmatrix} (37-36) & 0 \\ 18 & 9 \end{vmatrix} = +1 \times 9$$

The rule for the transposition of two adjacent lines is one which need not be learnt but it is sometimes found useful. If two adjacent lines (or columns) are transposed, the resultant determinant is numerically equal but opposite in sign. Thus:—

$$\begin{vmatrix} 1 & 2 \\ 3 & 1 \end{vmatrix} = 1-6 \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (13)$$

$$\begin{vmatrix} 2 & 1 \\ 1 & 3 \end{vmatrix} = 6-1$$

Therefore:—

$$\begin{vmatrix} 1 & 2 \\ 3 & 1 \end{vmatrix} = -\begin{vmatrix} 2 & 1 \\ 1 & 3 \end{vmatrix} = \begin{vmatrix} 2 & -1 \\ 1 & -3 \end{vmatrix}$$

To take a more difficult case:—

$$\begin{vmatrix} w & x & y & z \\ 1 & 3 & 4 & 2 \\ 6 & 5 & 3 & 9 \\ 4 & 1 & 7 & 2 \\ 10 & 3 & 15 & 4 \end{vmatrix} \begin{matrix} \\ \ldots . a \\ \ldots . b \\ \ldots . c \\ \ldots . d \end{matrix} = -\begin{vmatrix} 1 & 3 & 4 & 2 \\ 4 & 1 & 7 & 2 \\ 6 & 5 & 3 & 9 \\ 10 & 3 & 15 & 4 \end{vmatrix}$$

$$= +\begin{vmatrix} 1 & 2 & 4 & 3 \\ 4 & 2 & 7 & 1 \\ 6 & 9 & 3 & 5 \\ 10 & 4 & 15 & 3 \end{vmatrix}$$

Here we have interchanged (b) and (c) (−), then (y) and (z) (wxzy) (+), then (x) and (z) (wzxy) (−), and finally (x) and (y) (wzyx) (+).

If in a determinant any line has a common multiple it may be removed and the determinant is then this number of times as much. In the following example the third line is divisible by 20 and the second column by 2, which gives us:—

$$\begin{vmatrix} 1 & 6 & 2 \\ 4 & 2 & 7 \\ 60 & 160 & 100 \end{vmatrix} = 20 \times \begin{vmatrix} 1 & 6 & 2 \\ 4 & 2 & 7 \\ 3 & 8 & 5 \end{vmatrix} = 40 \times \begin{vmatrix} 1 & 3 & 2 \\ 4 & 1 & 7 \\ 3 & 4 & 5 \end{vmatrix}$$

The foregoing represents the most useful methods simplifying determinants and by using these elementary rules, any number of simultaneous equations can be rapidly solved, as will be shown in Part 2 of this article.

(To be Concluded)

New Zealand Projects

Further Hydro-Electric Development

TEST bores are being made to investigate the foundations at Waipapa, the next big hydro-electric project which the Ministry of Works is to tackle on the Waikato River. The 52ft high dam and 45,000 kW power plant will take four or five years to complete. Overseas engineers have been given a contract to plan the dam at Atiamuri and if the Government decides to let overseas contractors build it—as with the big South Island project at Roxburgh—work may begin there before a start is made at Waipapa.

Late delivery of essential equipment from Britain has seriously interrupted the construction schedule on the Whakamaru project. It is still hoped to finish the dam on schedule late in 1955, but further delays would make this impossible. The main hold-up has been caused by the non-arrival of the large concrete batching plant, which mixes 80 cu yd an hour, and the two radial cableways which will deliver the mixed concrete to any point on the site.

Workers Flown from Britain

Fifty employees of the London contractors Holland & Hannen and Cubitts, Ltd., have arrived by air at Roxburgh, Central Otago, New Zealand. There the firm is engaged on the hydro-electric power project and say it is almost impossible to obtain sufficient labour in New Zealand. The men have been specially selected with a view to their becoming permanent settlers in that country.

Industry and the House

Breadalbane Scheme Attacked

By A. M. F. PALMER, A.M.I.E.E., M.P.

THE anti-electricity forces in the House—if that is not an unfair description—staged a general attack this week; everything was done in the best military style. A creeping barrage of questions was first put down by the irrepressible Mr. Nabarro on the finances and installations of the Scottish Hydro-Electric Board, culminating in a major attack on a particular objective—the Breadalbane project—late on Wednesday evening.

The propaganda and "indoctrination" departments of the attackers had hummed busily beforehand. Notes had appeared here and there in the lay Press, especially the Scottish papers, all intended to show that Breadalbane, one of the largest schemes as yet designed by the Hydro-Electric Board, was expensive and unnecessary, and that Highland electricity could be supplied much more cheaply and conveniently at a fraction of the capital cost from thermal stations as yet unborn. That this argument invalidated the basic conceptions of the Cooper Report and, indeed, the 1943 Act as well, was so much tinsel stuff apparently. However, when the grand attack was actually mounted it was seen that the attackers were not at all sure of themselves, in spite of the blood-curdling war cries of their General. The defence turned out to be calm, strong, and well supplied with up-to-date ammunition by the coincidence of the arrival of the annual report of the Hydro-Electric Board on the very day when Breadalbane was to be destroyed.

Cost of Scheme

Colonel Gomme-Duncan, who sits for Perth, opened by moving that the Breadalbane project (Construction Scheme No. 25) be annulled. The scheme, he thought, was not one which should have an early priority in capital allocation. It had been estimated to cost £15·5 million, which had since been amended to something like £18·5 million. The Colonel was brief in his remarks and in this he was imitated by other Scottish Conservative Members, who disclaimed any desire to hinder the Hydro Board. Not so Mr. Nabarro who breathed deep fire at the co-existence of his *bêtes noires*: large-scale electricity expenditure and public ownership. There was "every reason," he thundered, "to condemn a nationalized undertaking which made an error of 20 per cent in its estimates." Breadalbane was "economically undesirable, technically moribund and financially improvident."

Since the writer was involved in these lively controversies, he feels inhibited from commenting further. Sufficient to say that Mr. Henderson Stewart, Under Secretary for the Scottish Office, made a most effective defence of the project from the Government front bench. The attack collapsed ignominiously, Mr. Nabarro announcing in the tradition of the private soldier's famous letter home to his mother, that he would always vote against abhorred spendthrift plans—but not to-night!

Iron and Steel Bill

The Iron and Steel Bill Report stage is now concluded. In the last hours Mr. John Freeman, formerly Parliamentary Secretary to the Ministry of Supply, moved an amendment which sought to give the Minister power to direct the new Board in the national interest. He said the Opposition had never concealed their view that the Board was likely to be little more than a sham. The industry had behaved for many years like a "rogue elephant" without social responsibility; behind a façade of public supervision it intended to go on doing so.

Mr. Sandys smoothly countered by pointing out that the Opposition were now asking for much more sweeping powers of direction than they had thought proper to take to themselves under their own 1949

Act. He defined the difference between the two points of view: "The Opposition want to give the Minister a kind of rover ticket to interfere when and where he feels inclined. We, on the other hand, prefer to give to the Minister the necessary powers, but limited to what is clearly defined in the Bill." Mr. Freeman's amendment did not succeed.

A surprise concession by the Government was the insertion of an amendment to ensure that the Board should take full employment into consideration in making policy. This was undoubtedly a *volte-face* welcome to the Opposition, remembering still the Government's former assertion in Committee that to include full employment as an aim of the iron and steel industry would lead to difficulties. The Labour Party withdrew a fresh amendment on the point in favour of the Minister's draft. But not without telling him first that it was their "pressure," as they saw it, which had brought about his change of attitude.

This tactic of conceding the Opposition's minor demands wherever possible, even if in a roundabout manner, has been repeated by Mr. Sandys a sufficient number of times by now to demonstrate that it is part of a settled strategy. It is for the Conservatives a wise precaution; they are anxious to remove, so far as is within their power, any excuse for a future Labour Government to re-nationalize the industry. Signs of general Conservative back bench restlessness over fuel and power are growing. In a way, the attack on the Breadalbane hydro-electric scheme was one confused expression of this anxiety. Over a hundred Conservative M.P.s have signed a motion on the Order Paper demanding an "urgent inquiry" into the structure and administration of the National Coal Board. It calls also on the Government "as a matter of necessity" to take action to provide a national fuel and power policy.

It is obvious that the Government, and particularly Mr. Lloyd, the Minister of Fuel and Power, have moved cautiously since the General Election in dealing with the nationally owned coal, electricity and gas industries. The official Conservative policy has been "bi-partisanship" and continuity with the previous Labour administration.

Asked some time ago for the Government's attitude to the structure of the Coal Board, Mr. Lloyd contended that the primary responsibility for making changes must rest with the Board itself and the industry was already actively engaged in examining its organization. A similar situation exists in electricity supply. I sense that we are at the beginning of a most interesting parliamentary development.

PARLIAMENTARY NEWS

By Our Special Reporter

LAST week in the House of Commons Col. Gomme-Duncan moved to annul the North of Scotland Hydro-Electric Board (Constructional Scheme No. 25) Confirmation Order, 1953. He said that the scheme proposed to cover an area of roughly 1,600 square miles in one of the loveliest parts of Scotland. There were to be seven new power stations, about 25 aqueducts, six dams and 15 to 20 reservoirs. What would be the effect on the water supplies of that area of Scotland if this scheme was carried into effect?

The scheme would use a vast amount of material, particularly cement and steel, and labour. The estimated expenditure at first was £15½ million, but it had since been amended to about £18½ million. Should such a scheme have first priority for whatever amount of capital was available?

Mr. Nabarro, seconding the motion, said that the Breadalbane proposal was the largest and most costly hydro-electric scheme yet brought before the House. Its capacity was to be 88,500 kW installed, to develop a catchment area of 186 sq miles in Perthshire and Argyll, and it would take seven years to complete. The cost per kW installed would be £204, which compared with a figure of £68 for an orthodox steam or thermal power station. The scheme would have a plant load factor of only 40 per cent. A few miles away, just completed, was Britain's most modern power house, Portobello. There the load factor had reached the record figure for the United Kingdom of 80 per cent. He denied that the Breadalbane scheme would save coal, that it would contribute towards overcoming the shortage of electricity, or that it would lead to further electrification of the Highlands.

Mr. Woodburn said that while the Breadalbane scheme should be carefully examined, it ought not to be condemned by the fallacious arguments used by Mr. Nabarro.

Mr. Palmer, opposing the motion, said that the outstanding advantage of hydro-electric stations was that they were economical when used to supply electricity systems with poor load factor. There were not the stand-by losses they got in the steam stations. Mr. Nabarro had spoken as if load factor was inherent in the characteristics of a power station. It was nothing of the kind. Thermal efficiency was certainly inherent in the characteristics of a steam power plant, but load factor was determined by external conditions. Portobello had, of course, an 80 per cent load factor. So had Battersea, probably. The reason was that both were run quite deliberately, in the system of operation, as base-load stations. The general load factor of the British electricity system as a whole was well under 50 per cent, and that made nonsense of the argument that inevitably the load factor of steam stations was in advance of the load factor of hydro-electric stations.

Mr. Nabarro said that his argument was not in any way related to inherent power station problems. It was that an 80 per cent load factor denoted twice as active an employment of the capital investment.

Mr. Malcolm MacMillan maintained that to frustrate or halt the scheme would be to do a great disservice to the future economic and social development of the Highlands.

Mr. J. Henderson Stewart, Under Secretary for Scotland, said that the scheme would save 180,000 tons of coal a year. The Hydro-Electric Board was operating in such a way as to save the equivalent of about 600,000 tons of coal, and it would go on saving more and more as the new schemes came forward. The demands made by such a station on the engineering industry, and particularly that sector which produced heavy electrical plant and equipment, were considerably less than in the case of a steam station. The cost of producing electricity was substantially less than it would be by means of a steam station. They had to keep in mind the excessively high cost of distribution. He had never looked on this scheme as a parochial Highland affair; it was intended to be to the advantage of Scotland as a whole. He urged the House to help the Government in carrying it through.

Sir Herbert Williams criticized the scheme on the ground of expense, but eventually the motion to annul the Order was negatived.

Electricity in Scotland

Mr. Palmer asked the Secretary of State for Scotland if he would make a statement on the progress of the possible legislation mentioned in the Queen's Speech affecting the supply of electricity in Scotland.

Mr. James Stuart said the question was being carefully examined, but he was not yet in a position to make a statement.

Replying to Mr. Nabarro, Mr. James Stuart said that he was informed by the North of Scotland Board that the installed capacity of the plant it owned and operated at 31st December, 1952, was: Hydro-electric plant 391 MW; steam plant 131 MW; diesel plant 38 MW; total 560 MW.

Electronics Industry

During the Debate on the Air Estimates Mr. Ward, the Under Secretary for Air, said that work was proceeding on new electronic equipment. Electronics helped to increase accuracy and accuracy alone could overcome the limitations in numerical strength imposed on us. The complexity of this equipment had increased enormously as the performance of aircraft had gone up and a particularly heavy load had been imposed on the electronics industry. Research in radar was also going on.

Mr. Tomney asked if they could any longer leave the highly intricate electronics industry in the hands of private manufacturers. He urged rapid development for the fighting forces and the aircraft industry directly under the control of the Ministry of Supply. It was no good depending on the United States; electronics development in this country was far ahead of the United States. Our equipment was better than anything they could provide. But our force of technical experts needed to be expanded quickly and the Government appeared to be doing nothing about it.

Mr. Charles Orr-Ewing said that the electronics industry had £80 million of defence orders on its books and those were the direct result of the activities of the Ministry of Supply and other Government Departments.

Naval Developments

Mr. J. P. L. Thomas, the First Lord of the Admiralty, in presenting the Navy Estimates spoke of the Navy's research and development programme. The Admiralty, he said, expected to spend roughly two and a half times as much next year as they did two years ago on our underwater equipment and on the development of electronic valves. He said that he had been asked to tell the House something about the latest anti-submarine equipment in H.M.S. *Rocket* which was a British invention, and also about the propulsion machinery of our new warships. The anti-submarine equipment included two three-barrelled anti-submarine mortars which were linked to an Asdic set with an improved electronic fire control system. The mortars fired a pattern of large projectiles with a high degree of accuracy and the projectiles could be set automatically to explode at any given depth. When the range was closed and

the "electronic brain" had absorbed the necessary information from the Asdic set, the mortar was pointed automatically and the weapons were discharged electrically. The whole process was almost instantaneous.

The Royal Navy believed that the development of the gas turbine would prove to be as revolutionary in the marine engineering world as the change-over from fire tube to water tube boilers was at the beginning of the century. In the near future gas turbines would probably be found in some form or other in all classes of vessels.

Tax on Electric Vehicles

Sir Wavell Wakefield asked if the Chancellor of the Exchequer was aware that the sales of electric vehicles had fallen by "over 200 per cent" in the last six years, mainly due to purchase tax, and, in view of their utility purpose, the saving in dollars because their source of power was electricity and the fact that they assisted in evening out the load of the Electricity Boards, he would consider removing this tax.

Mr. Boyd-Carpenter said he had received many representations to this effect, but he could not anticipate the Budget statement.

Railway Electrification

Replying to Mr. Ernest Davies, Mr. J. G. Braithwaite (Parliamentary Secretary to the Ministry of Transport) said that it was hoped to complete the Manchester–Sheffield–Wath electrification project by 1955.

He understood from the British Transport Commission that the next electrification scheme in priority was the London to Southend line.

Fuel Policy Motion

A group of Conservative Members have tabled a motion calling upon the Government "as a matter of necessity" to adopt a policy designed to make the most efficient use of the nation's fuel and power resources. The motion refers to the grave concern caused by the latest increase in the price of coal which must have an adverse effect upon export trade and add to the burden of gas and electricity consumers, transport services, etc. It calls for an investigation into the operation of the N.C.B.

Liberal Members have tabled an amendment supporting the demand for the adoption of a national fuel policy but describing as inopportune the proposal that the operations of the National Coal Board should be investigated.

A Versatile Industry

SPEAKING at the March luncheon of the Oil Industries Club Sir George Nelson, chairman and managing director of the English Electric Co., Ltd., outlined some recent developments and achievements of the British electrical industry. After a reference to the Abadan power station, as an item of particular interest to his hosts, Sir George showed how wide a field of research and engineering was embraced by the electrical industry. He mentioned the export of 160,000 h.p. hydro-electric turbines from this country; the building of gas turbine sets up to 20,000 h.p.; the development of special aircraft engines with a weight of only 1 lb/h.p.; the production of the "Canberra"; and the entry of the industry into the guided-weapon field.

This diversity of activities was due to the recognition by the Government of the industry's immense research, scientific and manufacturing resources, backed by managerial experience, great skill and loyal personnel.

Other matters touched upon by the speaker were the electrical industry's co-operation with the steel industry; radio communication; electronic computers; and the development of atomic energy.

Domestic Fuel Costs

IN an effort to clarify the economic situation as it affects all-electric and other houses, and its consequent relationship with the North of Scotland Hydro-Electric Board, the Perth and Kinross County Council has examined the fuel accounts of eight Council tenants. The eight tenants were asked to submit their accounts over the past year, and the average expenditure has worked out as follows:—

All-electric house, £12 5s 6d per annum; all-gas house, £13 17s 10d per annum; house with gas cooker and electric light, £15 11s 8d (gas, £8 0s 6d, electric light, £7 11s 2d); house with solid fuel cooker and electric light, £18 4s 6d (cooker, £13 3s 6d, electric light, £5 1s).

The county architect has added that relative costs, based on tenders received for houses at Errol, show that the cost of a house with solid fuel cooker and wash-boiler is £40 more than an all-electric house.

Duke Visits Littlebrook

THE Duke of Edinburgh was presented with a stainless steel paper-knife made from a turbine blade when he visited Littlebrook power station, near Dartford (Kent), last week. The station, when completed, will be one of the largest in the south of England. During his hour-and-a-half tour, the Duke saw the "A" and "B" stations in operation and inspected the "C" station, which is now being built and which, when finished, will have a capacity of 240 MW. He was received by Lord Citrine, chairman of the British Electricity Authority, Sir John Hacking, deputy chairman (operations), Mr. W. C. Parker, controller of the South Eastern Division, and Mr. E. C. Avery, the station superintendent.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Radio Industry Council is to present to **Sir Noel Ashbridge,** who retired from the B.B.C. last year, a portrait of himself by Mr. Frank O. Salisbury. The portrait is nearly finished and it will be presented at a date to be announced.

Mr. T. E. Goldup, M.I.E.E., has been elected chairman of the Radio Communication and Electronic Engineering Association for 1953 in succession to Mr. K. S. Davies. **Mr. C. G. White** remains vice-chairman. Mr. Goldup is a director of Mullard, Ltd. He is a vice-president of the Institution of Electrical Engineers and chairman of the governors of the Ministry of Supply School of Electronics, Malvern, of which he has been a governor since 1949. He serves on committees of the British Standards Institution, and on the Radio Research Board, Department of Scientific and Industrial Research. Mr. White is director and general manager of the Marine Division of Kelvin & Hughes, Ltd.

Mr. T. E. Goldup

Mr. G. D. East has been appointed deputy power station superintendent at Castle Meads generating station of the South Western Division of the British Electricity Authority, with effect from 1st April. Before this appointment Mr. East was a shift charge engineer at the Ironbridge generating station in the Midlands Division.

Associated British Engineering, Ltd., has announced the appointment of **Mr. F. H. Harris,** B.Sc., as group production adviser. Mr. Harris was apprenticed to the British Thomson-Houston Co., Ltd., with which company he subsequently served as an industrial engineer before becoming production controller to Alfred Herbert, Ltd., an appointment he held for seven years. Until his present appointment he was works manager for B.S.A. Tools, Ltd., in Birmingham. He is a member of the Institution of Production Engineers, and served as a member and secretary of the Anglo-American Council's Productivity Team on metalworking machine tools which visited the United States in 1951.

The following new appointments have been made in the "Servis" electric washing machine sales organization of Wilkins & Mitchell, Ltd. :—**Mr. E. S. Holland,** Scottish divisional sales manager, becomes sales promotion manager; **Mr. J. F. Millar,** sales representative for Ayrshire and Dumfriesshire, becomes Scottish divisional sales manager, Glasgow; **Mr. F. McL. Bruck,** southern divisional sales manager, Wolverhampton, becomes northern divisional sales manager, Bradford; and **Mr. J. E. Gutteridge,** sales representative, west country, becomes southern divisional sales manager, Wolverhampton.

Mr. E. H. Plowman, Greenwich district engineer, Southern Sub-Area, London Electricity Board, has retired after fifty years' service in the electricity supply industry, and at a recent social and dance held at the Green Man Hotel, Southend Village, Catford, he was presented with a cheque from his staff and colleagues, past and present. The presentation was made by Mr. S. Eclair-Smith, manager of the Southern Sub-Area.

In our last week's issue we reported the appointment of **Mr. E. C. Scott,** B.Sc., A.M.I.E.E., as system operation engineer in the North Eastern Division of the British Electricity Authority in succession to Mr. A. W. Mitchell, who retires at the end of this month. We now reproduce a portrait of Mr. Scott.

Mr. E. C. Scott

Mr. F. H. Last, Ph.D., B.Sc., has been appointed technical engineer (electrical) of the Eastern Generation Division of the British Electricity Authority. After training at Queen Mary College, University of London, and with the Metropolitan-Vickers Electrical Co., Ltd., Dr. Last joined the Research Department of the Central Electricity Board in 1939 and during the war transferred to the Technical Department of the

A group taken during the Indian High Commissioner's visit to the Brush Electrical Engineering Co.'s works at Loughborough

South East England District. Since vesting day he has been senior assistant to the technical engineer (electrical) of the Eastern Division.

H. Frost & Co., Ltd., Walsall, announce the appointment of **Mr. C. E. T. Trafford** as home sales promotion manager. Mr. Trafford was formerly with John Parfield & Co., Ltd., Walsall. The company has also appointed **Mr. W. R. Willey** as export manager. Mr. Willey was formerly with Wrights Ropes, Ltd., of Birmingham.

Mr. W. L. Henderson, A.M.I.E.E., has resigned his position as assistant secretary to the Engineers' Guild, Ltd., as from 1st April next, which post he has held since 1948, in order to take up a position in industry. The General Council of the Guild has appointed **Mr. J. G. Orr,** M.A.(Cantab.), to succeed Mr. Henderson. Mr. Orr is a barrister-at-law, and until recently he was with the British Motor Trade Association.

Indian apprentices of the **Brush Electrical Engineering Co., Ltd.,** entertained the High Commissioner of India, His Excellency Shri B. G. Kher, when he visited Loughborough on 6th March. The visit was at the invitation of the Leicestershire India Association, which has its headquarters at Loughborough College. The party was received at the factory by Mr. J. H. R. Nixon, technical director and senior official of the company, and after a tour of the works the visitors had tea with the Indian apprentices.

Mr. J. A. Esplin, M.I.Mech.E., has joined the Traction Division of Crompton Parkinson, Ltd., at Chelmsford, as a senior traction engineer (railways). He joined the Buenos Ayres Great Southern Railway in 1924 and in 1949, on the reorganization of the ex-British owned railways, he was appointed chief of the Electrical Division of the General Roca Railway (formerly B.A.G.S.). He became technical adviser to the general manager in 1951. **Mr. W. R. Gordon** has been relieved of his present responsibilities in connection with trolleybuses in order to release him for special duties in connection with diesel-electric traction. **Mr. A. A. Morris** will take over the trolleybus section.

At the annual general meeting of the Electrical Wholesalers' Federation on 19th March **Mr. E. A. V. Peckham** (G. S. Peckham & Co., Ltd.) was elected president for the ensuing year. Mr. Peckham joined the Council in 1949 on the retirement of Mr. C. E. Vines, and served for a year as councillor of the London and Eastern Section. He was subsequently re-elected as a general councillor. **Mr. T. D. Woods** (Downes & Davis, Ltd.) was elected councillor of the North Western Section to follow Mr. W. H. Swain, the retiring president, and **Mr. A. T. Haywood**

Mr. E. A. V. Peckham

Mr. T. D. Woods

Mr. A. T. Haywood

(Electrical Components, Ltd.) was elected councillor of the Midlands Section in succession to Mr. J. M. Hollander, past-president, who is retiring from the Council. **Mr. J. W. E. Rutherford** (Adamson & Co. (Tyne), Ltd.) was re-elected a general councillor.

Mr. D. J. Greene, works manager of the Micanite & Insulators Co., Ltd., has been elected to the board of the company.

Lewden Meter Products, Ltd., inform us that their agent, **Mr. B. M. Weill,** is recovering from his illness and hopes to resume his activities in the immediate future.

Mr. James Ferguson, of the South East Scotland Electricity Board, Edinburgh, has been appointed accountant to the Jersey Electricity Co., Ltd.

Nearly 1,500 visitors took advantage of an invitation issued to employees and members of their families to visit the cable factory of **W.T. Henley's Telegraph Works Co., Ltd.,** at North Woolwich on Saturday last. Among the special features were competitions between the different shops. Each shop had set out a display representing its own activities, and awards were made for the best displays and for the cleanest and smartest shop. The winners for the displays were :—First, Tubing Department and second, Rubber Mill. The Braiding Department gained first place for the smartest shop, with Rubber Covering as a close second. Awards were also made for the best shop sign. Mrs. Savage (wife of the works manager, Mr. J. H. Savage, M.I.E.E., M.I.W.M.) handed the foremen of the winning shops plaques recording their success.

The 1953 reunion of the **Edmundsons Group** will take place at the Holborn Restaurant, London, on 24th April. Tickets (16s 6d each) can be obtained from Mr. F. T. Scribens, British Electricity Authority, Room 425, Winsley Street, London, W.1, or Mr. R. H. Sharman, Room 212, Bankside House, Sumner Street, London, S.E.1.

OBITUARY

Mr. A. Hunt.—The Express Lift Co., Ltd., announces the death on 4th March, at the age of fifty-three, of Mr. Albert Hunt, commercial manager of the company. Mr. Hunt went to Northampton from Chatteris, Cambridgeshire, starting as an estimating clerk in 1929 with Smith, Major & Stevens, Ltd. On their amalgamation with the Express Lift Co., Ltd., in 1930, he continued in the Sales Department and eventually became its head. During the war years he was associated with the aircraft section of the Express Lift Co.'s war effort, and successfully co-ordinated the work of four factories, which were engaged on the production of the aircraft control panels for the Wellington bomber. After the war he again took over the Lift Sales Department, and was appointed commercial manager.

Mr. C. G. Curtis.—The death has occurred in America of Mr. Charles Gordon Curtis, who became well known towards the end of the last century for his invention of the Curtis steam turbine. Mr. Curtis was born in 1860 and was educated at Columbia University. For some years he practised as a patent lawyer, following which he organized the C. & C. Electric Motor Co., which was the first company in America to make electric motors and fans. Later he formed the Curtis Manufacturing Co., of which he became president. He sold his steam turbine rights to the American General Electric Co.

Mr. F. H. Reeves.—The death occurred on 15th March at Penn, Wolverhampton, of Mr. Frederick Harold Reeves, formerly managing director of the Revo Electric Co., Ltd. The funeral took place at Penn yesterday (Thursday).

Mr. Thomas William Caton, head of William Caton & Sons, electrical engineers, Oldham, has died at the age of seventy-four.

WILLS

Mr. J. Morton, M.I.E.E., M.I.Mech.E., chief engineer of the former West Midlands Joint Electricity Authority, left £11,919 gross (£11,869 net).

Mr. G. E. Smith, A.M.I.E.E., consumers' engineer in No. 6 Sub-Area, North Western Electricity Board, left £7,542 gross (£7,423 net).

Brigadier-General Magnus Mowat, C.B.E., T.D., formerly secretary of the Institution of Mechanical Engineers, left £31,519 gross (£31,357 net).

Mr. G. P. Dennis, M.I.E.E., chairman of G. P. Dennis, Ltd., and other companies, who died on 28th November, 1951, left £46,647 gross (£46,309 net).

Mr. J. Pinder, A.M.I.E.E., chief outside engineer with the J. L. Eve Construction Co., Ltd., who died on 18th December last, left £5,850 gross (£3,234 net).

Mr. R. C. Pierce, M.I.E.E., a former director of the Cambridge Electric Supply Co., who died on 10th January last, left £91,586 gross (£91,156 net).

S.E.B. Management Conference

At the third one-day management conference held at the Southern Electricity Board's head office at Maidenhead on 11th March, Sir Charles Renold gave an address on "The Aim of Joint Consultation." The conference was attended by the chief officers, sub-area managers, section heads, sub-area senior officers and district managers. Mr. H. Nimmo, chairman of the Board, who we are glad to hear is recuperating after his illness, made a special journey in order to be present at the conference.

Engineering and Scientific Technologists

THE word "symposium" means a convivial meeting for drinking, conversation and intellectual entertainment, and on Monday last the Old Centralians held a function at the Unwin Building, Imperial Institute Road, London, S.W.7, which certainly met this definition. The subject for discussion was "How Can Future Needs of the Country for Engineering and Scientific Technologists Best be Met?"

The first speaker was Sir Arthur Fleming, director of the Metropolitan-Vickers Electrical Co., Ltd., who dealt with the branch of industry concerned with the manufacture and operation of electrical plant and equipment. He outlined the personnel structure of this branch, pointing out the need for the continual advance in technical training of personnel to keep pace with expanding scientific knowledge; the importance of the creative mind; of the people able to apply new knowledge and particularly of those who, with a background of sound technical knowledge, also possess the ability to direct and manage the complex conditions of modern production.

Sir Frederick Handley Page, chairman of Handley Page, Ltd., then discussed the more fundamental problem of the type of recruit industry is seeking, particularly in the upper levels. He thought integrity of character, personality and ability to mix of great importance. Furthermore, a man should be able to remain contemporary in thought. That is, at the age of 40 he should think in terms of, say, science and technology of to-day (and of to-morrow) and not in terms of what he learned at the university 20 years earlier.

Mr. H. J. B. Harding, director of John Mowlem & Co., Ltd., expressed certain points of view as both a civil engineer and a civil engineering employer. He was followed by Prof. J. F. Baker, Head of Department of Engineering, Cambridge University, and Sir Wallace Akers, Director of Research, Imperial Chemical Industries, subsequently dealt with the needs of the chemical industry. Many other speakers took part in the proceedings, which altogether lasted about four hours.

Snowy River Progress

ON 6th March, after years of intensive planning, the first diversion of the Snowy River from its natural bed was successfully accomplished at Guthega, 5,600ft up on Mount Kosciusko. The water is now pouring through the 600ft Guthega diversion tunnel while bulldozers and excavators are working upon the construction of the first dam of the Snowy hydro-electric scheme. This dam will be a concrete mass of 750,000 tons, 500ft across and 100ft high. This is not so large as the later dams will be, but it is the first and is typical of the rest. The driving of the three-mile tunnel from Guthega to Munyang has now reached an interesting stage. Previously earth and soft rock had held up the work at both ends of the tunnel, but solid rock has now been reached. Summing up the position, it seems probable that the initial timetable for completion of the various schemes will be kept without much variation.

I.E.E. Centre Dinner

DIRECT and indirect exports of the electrical engineering industry were of the order of £250 million and as such it took second place only to the motor vehicle industry, said Col. B. H. Leeson, President of the Institution of Electrical Engineers, at the annual dinner of the North Western Centre held at the Midland Hotel, Manchester, on 10th March. There was an attendance of more than 400. Mr. J. Prince (chairman of the Centre) presided.

Col. Leeson said that for over fifty years the North Western Centre, one of the largest Centres of the Institution, had represented an important cross section of the membership. The contributions of its members in the experimental and research fields were noteworthy. The profession and industry had grown rapidly during the last fifty years and with an increase of personnel at the rate of 50,000 a year now represented employment to the extent of over 900,000. Education and training of every kind were needed to keep pace with such rapid growth. More educational facilities, especially for higher technological education, were imperative and urgent. The engineering and metal industries together already represented over 50 per cent of the visible exports.

Dr. E. J. F. James, M.A. (Manchester Grammar School) commented on the North Western Centre's contribution to the advancement of the electrical sciences. Our future depended upon the manner in which we employed our resources of scientific ability and inventiveness in the technological applications for the benefit of industry and the State. The I.E.E. helped to diffuse into everyday life the discoveries of the specialist and conferred on the community the benefits of increased knowledge and developing techniques.

Mr. J. Prince proposed the toast of the guests, for whom Dr. F. C. Toy, Director of the Shirley Institute, replied.

It was decided to send from the dinner a message of greeting and good wishes to Mr. A. L. Green, who has been assistant secretary for fifty years. This was the first annual dinner he had not attended in that time, but illness now kept him away.

Insulating Materials

Three-day Symposium at the I.E.E.

THIRTY-TWO specialized papers reviewing recent advances in the science and technology of electrical insulants and surveying current trends in the insulation of electrical equipment, were presented during a three-day symposium held by the Measurements Section of the Institution of Electrical Engineers in London this week (16th to 18th March). Altogether there were five technical sessions each dealing broadly with a particular aspect of the subject. As a departure from normal procedure each was opened by a rapporteur who summarized the papers in that session. The discussion on the papers followed immediately and an opportunity was subsequently given to the authors to reply. The papers were not read by the authors in the ordinary way.

Overseas Interest

The proceedings were opened on Monday evening by Col. B. H. Leeson, President of the Institution, who said that the importance of the subject was illustrated both by the large attendance and by the fact that twenty representatives of ten overseas countries were present.

After mentioning the Ferranti cable from Deptford to London (installed in 1890 and in service until 1933) as an outstanding example of insulation engineering, he said that he looked on insulation from two distinct points of view. The first was its ability to stand up not only to the normal voltage to which it was subject but also to abnormal conditions. The second was related to what some called ageing but he preferred to define it as the quality of durability or vitality, the ability of the insulation to stand up to its task over a long life. It was necessary to conduct research into and study the mechanism of breakdown to improve the way in which insulation could be tested to ensure long life. In that connection it was appropriate to refer to quality control, because however carefully the properties needed in a certain insulating material might be specified it had to be made in a factory by human craftsmanship.

We were confronted to-day with the kind of problems which had had to be faced fifty years ago, but in an accentuated form, with ever-increasing voltages, ever-increasing short-circuit currents and more severe conditions in every respect. The materials must function properly over a greater range of temperature and must be immune from the effects of advances made in other fields, such as radioactivity. Never before, therefore, had there been a greater opportunity for further development in respect of both the strength and the durability of insulation than existed to-day.

The first session was then opened under the chairmanship of Dr. L. Hartshorn and as rapporteur Prof. Willis Jackson dealt with six papers on permittivity and dielectric losses in solids. On Tuesday afternoon the second session took place with Mr. J. F. Coales in the chair, the subject being permittivity and dielectric losses in liquids (five papers) and the rapporteur Dr. L. Hartshorn.

The third session, with Mr. M. Whitehead in the chair, included ten papers on electric strength and breakdown, and Dr. S. Whitehead acted as rapporteur. The latter was chairman on the following afternoon, when Dr. R. W. Sillars dealt with eight papers on general properties and current problems. Dr. L. Hartshorn took the chair for the final session in the evening when the subject was classification, specification and testing, Dr. T. E. Allibone being the rapporteur.

Western Uganda Scheme Abandoned

IT is reported from Kampala that the £2 million project for transmitting electricity from Jinja to Kilembe, in Western Uganda, has been abandoned. The Kilembe mines, which were to have paid £1,500,000 sterling towards the cost of the line, have decided to transfer copper smelting operations nearer the source of power at Jinja.

VIEWS on the NEWS

By REFLECTOR

A GREAT deal is being made nowadays of floodlighted football matches, but they are no novelty. Searching for something else in the files of the *Electrical Review*, I came across the following in the issue of 1st November, 1878:

> "A football match by electric light was played at the Bramall-lane Grounds on the night of October 14th. Upwards of 30,000 people gathered to see the match, which commenced at 7.30 p.m. The light was thrown on the ground from four lamps, each thirty feet from the ground, and the rays lighted up nearly the whole of the grounds, so that the players could be seen almost as clearly as at noonday. The brilliance of the naked light sometimes dazed the players and caused strange blunders, but the match was highly successful. Behind each goal was placed a portable engine, which drove two dynamo machines, one for each light. The illuminating power was equal, it is said, to 8,000 standard candles, and the cost per hour for each light was 3½d."

* * *

Farmers are often difficult clients for Electricity Boards to deal with but no doubt they sometimes think that the Boards are awkward. From the South Western Area comes a report that a farmer who was apparently using electricity in his house on the Board's domestic tariff has been switched over to the farming tariff because he uses two or three kWh a year for shearing a small flock of sheep. In consequence, instead of having to use 60 kWh at the rate of 5d before going to the next step of 2d/kWh, he now has to consume 120 kWh and he reckons that his quarterly bill will be increased by £2 or more. I suppose he might have avoided this by shearing the sheep in his kitchen.

* * *

Adverting to my note of 27th February about American and British usage in the matter of aluminium, the Aluminium Development Association draws my attention to one of its publications in which the matter is discussed. Pliny, it is said, in the first century of this era used the word *alumen* to describe certain natural mineral salts, now believed to have been mixed sulphates of aluminium and zinc. This name has persisted in the group of salts known as "alums." Then the notes refer to Sir Humphry Davy's use of the term "alumium," later "aluminum" and later still "aluminium." It is stated that "in America and Canada, difference in pronunciation stress had its effect," but I should think it is rather difficult to place the stress on the second syllable of aluminium.

* * *

A *Southern Daily Echo* headline, "B.E.A. Will Book Seats by Electricity," does not, as might be inferred, relate to Coronation viewing arrangements for electricity authorities' staffs. It refers to a system installed by British European Airways for visually indicating passenger bookings at its Lower Regent Street headquarters. I am always being let down by this confusion of initials.

ELECTRICAL RESEARCH

Recent Publications of the E.R.A.

AMONG the recently published reports on the work of the British Electrical and Allied Industries Research Association, Report Ref. G/T261 "Simplified Calculations for Rate of Rise of Restriking Voltage," by J. A. Callow, B.E., B.Com., A.M.I.E.(Aust.), (12s) describes a simple approximate method of evaluating rates of rise of voltage directly from the circuit constants of supply networks. The method can be used to obtain either the simple rate of rise for single frequency circuits, separate rates of rise for the higher and lower frequency components of double frequency circuits, or, for the latter, an equivalent rate of rise according to the convention suggested by J. S. Cliff.

The method given should provide a satisfactory means of rapidly surveying the range of rates of rise of voltage to which switchgear at a given site or number of sites is subject. While the calculations are only approximate, and in the more complicated cases cannot be supported by theoretical reasoning, the method will clearly indicate which of a given number of conditions are those which set limits. The latter may then be examined more closely by complete analysis, in which appropriate account can be taken of details of network parameters which are neglected in the wider survey. Such a complete analysis is in any case necessary to show precisely the form of the transient, a piece of information which, in the present state of the art, it is probably necessary to study when limits are being considered.

Ferro-electric Materials

Report Ref. L/T257 "Report on Researches with Ferro-electric Materials," by H. F. Kay (12s) deals with recent work performed in the Physics Department of Bristol University. The chief aim of this programme has been the production of crystals suitable for X-ray and optical crystallographic studies, which means that only very small crystals have been produced. Crystals suitable for electrical investigations are of necessity much larger and such production has not been attempted in this laboratory. It might be added, however, that some effort might be usefully expended in this direction, but emphasis must be laid on the fact that special furnaces will be required and the services of an inorganic chemist might be essential.

Report Ref. G/T368 "Intrinsically Safe Electrical Apparatus: Relation of Igniting Current to Circuit Inductance for Inflammable Mixtures of Benzene and of Cyclohexane with Air," by E. M. Guenault, M.Sc., Ph.D., and E. Atherton (6s) covers the determination of the range of mixtures with air of the vapours of benzene and of cyclohexane which are the most easily ignited by the sparking produced by rapid interruption of an inductive circuit, and of the relation, for such mixtures, of igniting current to the circuit inductance. It is found that these mixtures are very similar in their ignitability to the most readily ignitable mixtures of pentane and air.

Fuse Performance

Report Ref. G/T266 "The Performance of 440 V a.c. Fuses with Small Over-Currents," by H. W. Baxter, B.Sc.(Eng.), A.M.I.E.E. and M. T. Cree (10s) extends the work recorded in Report Ref. G/T204 which dealt with fuses rated at 30 A. It appears from past tests that some fuses may have difficulty in breaking small over-currents. The test facilities then available permitted only a.c. fuses of up to about 30 A rating to be tested and the results were largely negative, in that no failures occurred.

It was thought that the tendency for a fuse to fail with small over-currents might be more pronounced with fuses of larger current ratings, and the recent installation of new equipment and the provision of additional power supplies (sustained currents up to 700 A at 440 V) have enabled the performance of fuses of up to 400 A rating to be investigated. Fuses of smaller rating than 200 A were not tested, because there appeared to be no need for investigation below this current.

The investigation was confined to commercial fuses since this enabled several

different forms of construction, difficult to reproduce in the laboratory, to be investigated. All were 220 V B.S.88 : 1947 category A.C.4 fuses.

The increase in the use of selenium in industry in recent years has been very rapid and demand has already outstripped supply by a considerable margin. The economic and technical consequences of this situation, particularly in relation to the electrical industry, are discussed in Report Ref. Z/T90 "Review of the Technical and Economic Position of Selenium," by A. M. Cassie, M.A., B.Sc., M.I.E.E. (10s 6d). The author deals with the subject in terms of (a) increasing supply, (b) search for alternative materials and devices, (c) economy in use and recovery, both in production and after service, and (d) allocation of existing supplies amongst the various claimants. It is concluded that the matter is a matter of importance and urgency in overcoming in part the short-term needs of the situation. Long-term requirements can be met only by intensive research and development of alternative materials and devices in all the user industries concerned.

Tests on an Italian design of a 275 kV single-circuit suspension tower are described in Report Ref. O/T9 "Tests on Italian Design of a 275 kV Single-Circuit Suspension Tower," by P. J. Tyle, B.Sc.(Eng.) (10s 6d). Descriptive comparisons are also made between British and Italian (Societa Anonima Elettrificazione) tower designs.

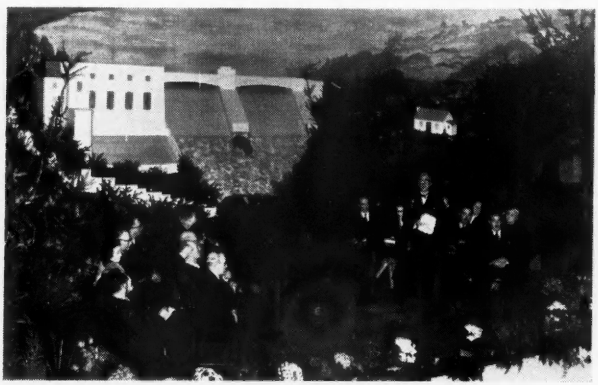
Copies of the above-mentioned reports are available, at the prices indicated in parentheses, on application to the Electrical Research Association, Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

Perth Electrical Exhibition

MR. THOMAS JOHNSTON, chairman of the North of Scotland Hydro-Electric Board, in opening the largest all-electric exhibition ever held in Scotland at Perth on 10th March, described the Breadalbane project as being of fundamental importance not only to the national economy but also to the prosperity of the Highlands. Mr. A. Grant, the Board's South Caledonia area manager, said that while the exhibition was sponsored and organized by the North of Scotland Hydro-Electric Board, it had been well supported by the manufacturers in the displays upon the individual stands. With over 3,000 exhibits the display featured the products of over seventy of the best known electrical manufacturers.

Before the opening of the exhibition a luncheon was held attended by members of the Board, representatives of Perth Town and County Councils, manufacturers and exhibitors and the Scottish Special Housing Association. Speaking at the lunch Mr. Johnston said that it was expected that the change-over from d.c. to a.c. in Perth would almost be completed by the end of this year. At vesting date there were 7,300 d.c. consumers in Perth city, and now there were only 1,341. In the Board's South Caledonia Area, which included Perth, Angus and part of Stirlingshire, there were 66,000 potential consumers, of which 46,000 had already been connected to the mains.

The artistic highlight of the exhibition was the large-scale model of the Board's Pitlochry dam and power station, complete with fish ladder. The exhibition closed last Saturday.



The Rt. Hon. Thomas Johnston speaking at the opening of the "Energy Electrical" Exhibition held in Perth last week

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Back-Pressure Generation

AS an engineer engaged in works maintenance and operation, I would like to support Mr. Morcom from the other side of the fence on the points he made in his letter in your last issue.

The back-pressure turbine, or steam engine, should always be considered in any circumstances where steam has to be generated for process purposes or heating. Several schemes I have evaluated have usually shown a return on investment of 30–35 per cent. Assuming that the steam generation is essential, the return on investment is calculated on the extra money required for increased boiler pressure, the back-pressure engine and electric generator and switchgear.

Using induction generators, I consider schemes down to 30 kW with single-cylinder back-pressure reciprocating engines using a pressure as low as 250–75 lb/sq in back pressure. I run the sets in parallel with the public supply. The paralleling presents no problem with the induction generator.

If every suitable steam pressure reducing valve in industry were to be replaced by a back-pressure engine driving a generator, then I believe the peak load problem would disappear.

If the back-pressure engine shuts down inadvertently for more than half an hour the increased maximum demand thereby incurred is charged for the whole twelve months. This does not encourage the installation of back-pressure engines. If the maximum demand charge was extended over three months instead of twelve, it should still fulfil its intended function and yet provide encouragement to industry to install back-pressure engines and generators.

Mr. Morcom is right when he says that the steam/electric balance in industrial works is always tending towards unbalance due to the constantly increasing use of electricity, but this should not prevent the installing of back-pressure engines and generators of all sizes from 30 kW upwards, and if these are connected in parallel with the public supply the steam/electric balance does not matter.

Sale, Ches. F. A. RICHMOND.

Interfering "Zebras"

WE would like to refer to the letter from Mr. John Baggs, of Oldham, in the 13th March issue of the *Electrical Review* on the subject of interference with radio and television reception from flashers used to control the lighting of zebra beacons.

The flashers manufactured by us comply with B.S. 800, and have been fully approved by the General Post Office for efficient suppression. Tests have shown that no interference will be experienced from these flashers even after a year or so's wear, when, as Mr. Baggs states, the contacts may become pitted. Every flasher is individually tested before despatch, on G.P.O. approved radiation interference test equipment.

VENNER, LTD.,
J. H. Rawlings,
Asst. Sales Manager.

New Malden, Surrey.

AUSTRALIAN NEWS

QUEENSLAND suppliers of refrigerators are faced with the biggest boom for many a year, as under the latest industrial awards refrigerators have to be supplied to workers in construction works, meat works, the pastoral industries, sawmills, shearing sheds, sugar farms and sugar mills.

The Royal Commission on television is now hearing evidence, and it is extremely unlikely that Australia will have this form of entertainment until 1956. Manufacturers are debating whether to produce a standard set for use anywhere in Australia, or whether to manufacture sets for use in each capital city. One American producer claims that he could manufacture sets in Australia to sell for £75.

Electrical Housecraft Conference

Next Week's Meeting in London

THE annual conference of electrical housecraft advisers and senior demonstrators, arranged by the British Electrical Development Association and the Electrical Association for Women, is being held next week from 24th to 27th March at the Assembly Hall, Royal Empire Society, Craven Street, London, W.C.2.

An opening address will be given by Lord Citrine, chairman of the British Electricity Authority, on Tuesday at 10 a.m. This will be followed at 10.45 a.m. by an address by Mrs. E. R. House, H.M. Inspector of Housecraft, Ministry of Education, on "Food in the Teaching of Housecraft." "The Importance of the Cooking Load," is the subject of a paper to be given at 2 p.m. by Mr. N. F. Marsh, chief commercial officer, East Midlands Electricity Board. Miss M. Marris, eighth Caroline Haslett Trust exhibitioner, will speak at 5 p.m. on her visit to Norway.

On Wednesday morning a talk by Miss E. M. Eaves (E.D.A.) on "The Art of the Demonstrator," will be followed by practical demonstrations of cooker sales. In the afternoon Mr. E. M. Ackery (E.D.A.) will speak on "Some Aspects of Commercial Catering," Eileen Cassidy, catering officer, London Division, B.E.A., dealing with "The Practical Side of Commercial Catering." Later there will be a display of E.A.W. and E.D.A. services, with a showing of E.D.A. films.

At the Building Centre on Thursday morning Marguerite Patten (B.B.C. Television) will give demonstrations of small appliances. Visits have also been arranged for this day to both the Ideal Home Exhibition, Olympia, and the Electrical Engineers' Exhibition, Earls Court.

A paper by Mary Gilbert (E.D.A.) on "Consumer Relations and Us," given at the Connaught Rooms, will be followed by a general discussion and, at 1 p.m., by the conference luncheon. From 3.30 to 6 p.m. the E.A.W. will be at home to delegates at its headquarters at 35, Grosvenor Place, S.W.1.

Electricity in Housing

MEMBERS of housing authorities, architects and builders, as well as people who are building their own houses, should find a new 20-page booklet produced by the British Electrical Development Association of considerable value. Entitled "Making the Best Use of Electricity in Housing" this publication deals succinctly but very thoroughly with the layout of the domestic installation to ensure that not only is there adequate provision for the many electrical appliances with which modern houses should be equipped but that the arrangements shall be the most convenient for their use.

The booklet starts with the costs of distributors and services on housing estates and explains why Electricity Boards are willing to do the work at lower charges when houses are so wired that the tenants are able to make full use of electricity if they want to. The next section stresses the value of heat-insulating construction of houses and it is pointed out that one solid fuel appliance cannot be expected to carry out efficiently space heating, water heating and cooking. The best plan is shown to be to confine the solid-fuel appliance to heating and water heating, the latter service being supplemented by an electric immersion heater. Cooking should be done electrically: the popularity of the electric cooker is emphasized and its attributes are set out.

Methods of installing and operating combined coal and electric systems are explained, with particular reference to the supply of hot water in flats. After a mention of the wash-boiler and washing machine the booklet turns to the beneficial effect of electrical appliances on the planning of small houses to make the best use of the available space. The rest of the publication is devoted to the wiring installation and shows the principal requirements for various types of houses. The advantages of the ring main system are explained. There are many good photographic illustrations and drawings to show typical layouts of wiring and appliances.

Aid for E.I.B.A.

THE Electrical Wholesalers' Federation's annual collection for the Electrical Industries Benevolent Association in 1952 again reached a record figure—£2,819, over £585 more than in 1951. The E.I.B.A. Cup, presented annually to the Section of the Federation which has the highest average of contributions per head has again been won by the London and Eastern Section for the second successive year, with an average per head of £20 12s 6d.

Cable Spiking

Results of Tests Made by the London Electricity Board

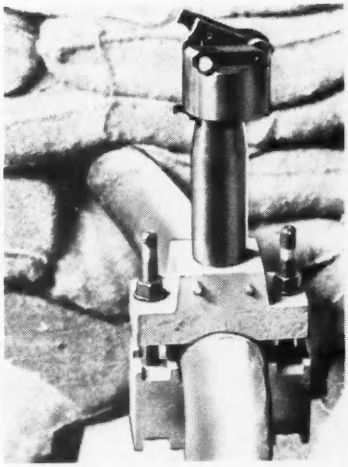
WHAT is generally called "cable spiking" has long been recognized as a means of ensuring the safety of men about to work on electric cable that is thought to be "dead," other practicable methods of identification having been carried out.

Various types of striking tool for this purpose have been evolved which clamp round the cable to enable a chisel point to be driven into the cable by direct blows, or by blows upon an extension rod to permit the striker to be far enough away from the fault to avoid the possible danger that might follow the piercing of a "live" cable.

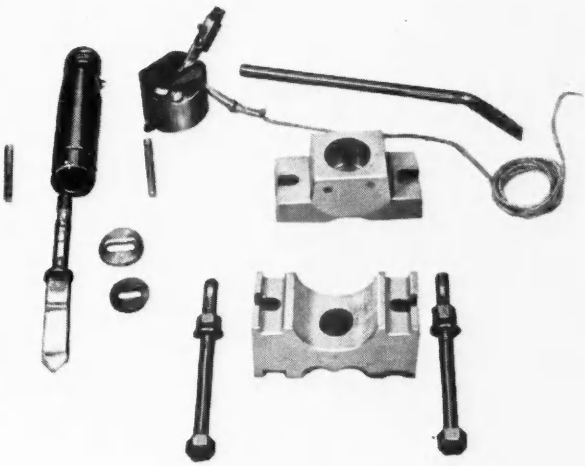
Experiments on H.V. Lines

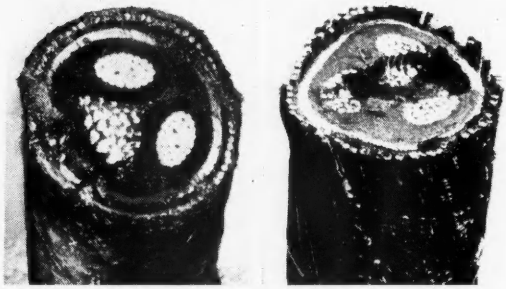
To permit an assessment of the probable consequences of using such an implement on a wrongly identified cable, tests were made by the London Electricity Board on an 11 kV live cable at a striking point where the short circuit MVA approximated to 75. Two types of striking tool were used: one being a proprietary article while the other was designed and made in the Board's Western Sub-Area.

The resultant flame and damage sustained by the tools prompted an experiment with a distantly controlled power-operated spiking tool and an opportunity during constructional work connected with the Bankside generating station was used to test a 22 kV cable (three-core, 0·25 sq in, paper insulated, lead covered and armoured) energized from Deptford West and looped temporarily from Bankside to a



Power operated spiking gun affixed to cable and *(below)* **component parts of the striking tool**





Cross sections of the 22 kV cable tested at the striking point in the first (*left*) and second (*right*) tests respectively

switch in a substation at Ewer Street, Southwark, with a tee connection to another substation at Spa Road, Bermondsey. The point of the test was 8,065 yd from the Deptford West generating station and the short circuit MVA available at the fault was calculated to be approximately 300. The gun was cartridge operated, triggered off by lanyard, its total weight being 37 lb, while the cartridge was a 0·38 special "blank" (safety small arm cartridge, Section 6, Division 1) which, when fired, provided the power to drive the piston punch into the cable.

The gun was provided by the courtesy of the chief engineer of the Midlands Electricity Board and the B.E.A. laboratories provided oscillographs and took photographic and sound recordings of the proceedings. The co-operation of the Post Office Engineering Department was readily obtained in recording voltages set up by the fault in neighbouring communication circuits, in a pilot cable laid in the same trench as the cable to be spiked and in providing communication circuits for the control of the tests.

The London Division, B.E.A., provided facilities at Deptford West and Bankside generating stations and made various temporary switching arrangements for the security of the general supply. The London Electricity Board Meter and Test Branch made temporary modifications of system protection so that the fault would be correctly cleared.

Two tests were made on a "live" cable on 9th March, 1952, and on 23rd March, 1952. The gun accomplished its task perfectly in both, there being no visible or audible disturbances at the point of spiking. There was no possibility of danger to operators or damage to adjacent cables.

On the occasion of the first test the fault affected one core only (B phase) because the experimental loading of the cartridge gave insufficient force to penetrate all three phases. An oscillogram of the fault current showed the fault duration to be 19 cycles, the oscillogram being free from any distortion. The voltage drop across the 4·99 ohm neutral earthing resistor at the power station was 11·6 kV (± 10 per cent).

The oscillogram of the fault currents in the second test (all three phases involved) showed the fault duration to be 17 cycles and the current 7,860 A (r.m.s.) per phase. In this test no voltage drop was recorded across the neutral earthing resistor at the power station, indicating the speed with which the chisel connected the three cores of the cable.

It is concluded from a report on the tests that the absence of appreciable visible or audible disturbance at the point of spiking was such that it could not be said with certainty whether the cable spiked was alive or dead at the time of spiking.

The tests have demonstrated that cables alive at 22 kV may be spiked without risk to operatives and without danger to adjacent cables by using the cartridge operated cable spiking gun. Measurements have shown no danger of voltage rise on the cable sheath at the point of spiking and, under the conditions of the test, no serious rise in potential of the earthing system at the power station feeding power into the fault. What is even more pleasing from the Post Office point of view is the fact that measurements on parallel communication circuits indicated that the induced voltage was not high and that in big cities where there are large numbers of power cables, which provide adequate screening, the likelihood of dangerous induced voltages in communication circuits due to earth faults on the power system is small.

We are indebted to Mr. D. B. Irving, B.Sc., M.I.E.E., chief engineer, L.E.B. for the above information and illustrations.

COMMERCE and INDUSTRY

Newfoundland Development Plans

Purchase Tax Recommendations

THE negotiations which have been taking place between the Newfoundland Government and a Syndicate of British and Canadian interests have now been concluded. The Syndicate is forming a new Corporation to be incorporated in Newfoundland, which will be known as the British Newfoundland Corporation, Ltd., the objects of which will be to explore and exploit certain selected areas in Newfoundland and Labrador. The Corporation's offices will be in St. John's. The authorized capital of the Corporation will be 10,000,000 shares of no par value and funds will be provided to permit the Corporation to carry out the first stages of its undertaking to the Newfoundland Government, namely, the expenditure on exploration and examination of the natural resources of the Province of a minimum of Can. $1,250,000 during a five-year period. Second, third and fourth five-year exploratory periods are contemplated involving the expenditure of similar minimum amounts. Member companies of the Syndicate include the English Electric Co., Ltd. Mr. B. C. Gardner has accepted the invitation of the Corporation to become its first president.

New B.I.C.C. Australian Company

British Insulated Callender's Cables, Ltd., has announced that its plans for the formation of a subsidiary company in Australia have been completed, the company having been registered in Victoria with the name British Insulated Callender's Cables (Australia) Pty., Ltd. The authorized capital is £A.1,000,000 of which £A.400,000 has been issued and the registered office is at 84–88, William Street, Melbourne, C.I., Victoria, with branches in other Australian States. Sir T. Malcolm Ritchie, M.I.E.Aust., will be the first chairman and the board will consist of prominent Australians and the B.I.C.C. resident executives in Australia.

B.I.C.C. has been directly represented in the Australian continent for more than fifty years, with offices at Melbourne and Sydney and agents in all State capitals and a number of other cities. The new company will take over the existing branches and will co-ordinate the activities of agents, the principal objects being to produce a greatly strengthened and expanding selling and technical service organization, and to co-ordinate the many trading interests of B.I.C.C. The company will also engage in construction and installation work in collaboration with British Insulated Callender's Construction Co., Ltd.

Industrial Productivity Report

The British Electrical Development Association has now published in book form a verbatim report of the proceedings of the Industrial Productivity Conference, organized by the Association, which was held in London in October last. A limited number of copies of the report are available from the Association at 2, Savoy Hill, London, W.C.2.

Eastbourne Catering Trades Show

Continuing its policy for the development of electrical catering equipment installations, the East Sussex and South West Kent Sub-Area of the South Eastern Electricity Board (manager, Mr. N. Boydell) has organized a special show this month of a complete hotel kitchen layout which has been installed in a café in the centre of the

Cooking section of Seeboard Catering Trades Show at Eastbourne

Eastbourne hotel area. Invitations sent to hoteliers and caterers in Eastbourne and surrounding resorts have brought a large number of interested consumers to the show. The kitchen layout was planned by the Simplex Electric Co., Ltd., which also supplied the cooking equipment, and a number of other manufacturers contributed kitchen machinery and appliances. The Board's Display Department provided descriptive notices and captions which explained the function of the appliances in each section.

R.E.C.M.F. Report

A further record in exports of radio and electronic products (£24·5 million) is announced in the report for 1952 of the Radio and Electronic Component Manufacturers' Association. As regards production during the year, there was a decline in the output of radio sets (including radiogramophones) from 2,090,000 in 1951 to 1,500,000, but the number of television sets produced, 800,000, was over 80,000 more than in the preceding year. Signs of a possible economic expansion in 1953 are detected; it is thought that some of the hampering restrictions on international trade will be relaxed. Conditions in the domestic field will be largely influenced by the Government's fiscal policy.

The Portuguese Market

In an article published in the *Board of Trade Journal*, the Counsellor (Commercial) and Consul-General at H.M. Embassy, Lisbon, discusses the prospects for United Kingdom goods in the Portuguese market. He says that Portugal has been a good market in the past, and the little additional effort now needed to overcome a passing slackness of demand and to meet the stronger competition from countries such as Germany, should be well within the power of United Kingdom exporters. The products of the heavy and light engineering industries will continue to be important exports to Portugal. United Kingdom exporters should also give special attention to radio receivers and equipment and domestic electrical appliances, including refrigerators. Exports from the United Kingdom were well maintained in 1952, the total value being £17·8 million, a large category being machinery (general) at £2,575,000. Other important items included internal combustion engines valued at £288,000; electrical generators and machinery (£218,000); electrical goods and apparatus (£778,000); and telegraph and telephone equipment (£340,000).

A Six Year Plan (1953–58) to co-ordinate, in the field of public works, communications, industry and agriculture, should favourably influence United Kingdom exports. The schemes under the Plan include an expenditure of £34·2 millions for the production and distribution of electricity.

Nature of Monopolies

Speaking at a meeting of the Manchester Statistical Society last week, Dame Alix Kilroy, former secretary to the Monopolies and Restrictive Practices Commission, pointed out that the Commission did not take the view that monopolies were necessarily inimical to the public interest. Competition did not always mean improved efficiency; it could often lead to low wages and inferior production. It was sometimes necessary for firms to combine and pool resources to enable them to set up plant for the modern techniques of mass production. The speaker quoted as an instance the co-operation of the General Electric Co. and the British Thomson-Houston Co. in the establishment of the large continuous ribbon machines for making electric lamp bulbs.

Works Visits

On 27th February Admiral Sir Michael M. Denny, K.C.B., C.B.E., D.S.O., Third Sea Lord and Controller of the Royal Navy, visited the Chelmsford Works of Crompton Parkinson, Ltd. He was accompanied by Sir Hamish D. MacLaren, K.B.E., C.B., D.F.C., Director of the Royal Naval Electrical Engineering Department, and other Admiralty personnel. The party visited all departments of the works and particular interest was shown in the equipment being manufactured for the Royal Navy, including instruments, motor generator sets,

Admiral Sir Michael Denny and Sir Hamish MacLaren inspecting Admiralty pattern switchboard instruments in course of manufacture at the Chelmsford Works of Crompton Parkinson, Ltd.

A display of Siemens lamps and Coronation devices at the Birmingham showrooms of the Midlands Electricity Board

and complete switchboards for inshore mine sweepers and frigates. During his tour the Admiral spoke with many of the supervisory staff and workpeople and thanked them for the work they were doing for the Royal Navy.

A team of twelve experts of the O.E.E.C. Intra-European Mission who are visiting this country paid a visit to the Lewisham and Rochester factories of Elliott Brothers (London), Ltd., and the Fisher-Governor Co., Ltd., on 10th March. They are all experts from Government Departments and leading industrial organizations of European countries who are touring O.E.E.C. member countries to compare methods employed in those countries for the manufacture of specialized equipment for the petroleum industry and to compile reports.

Discounts to Board Employees

Members of Brigg Chamber of Commerce heard on 11th March from their president, Mr. Ernest Taylor, a complaint that employees of the Yorkshire Electricity Board were allowed to buy television sets at a " very generous trade discount." Mr. Taylor, who is a radio dealer, suggested that these sets were not always retained by the individuals who bought them.

It was decided to ask the manager of the Grimsby Sub-Area of the Yorkshire Board whether the Board attached any conditions to the sale of television sets. Failing a satisfactory assurance, the matter would go to the " highest possible level."

Double Shift Working

When the Minister of Labour met T.U.C. leaders and employers' representatives at his National Joint Advisory Council recently, he discussed with them the possibilities of wider double day-shift working in industry. After considering the economic benefits of double shifts in industries where capital and overhead costs are high and the general advantage which would follow through electricity consumption being spread more evenly throughout the day, the N.J.A.C. agreed that some industries should be informed of these points and asked to hold discussions on them.

The N.J.A.C. suggests that when unions and employers in these industries have made up their minds about double shift working, the matter could go before the joint bodies in the industries to negotiate the method by which individual firms might adopt double shifts.

International Accumulator Conference

The light-weight silver-zinc accumulator being manufactured by Venner Accumulators, Ltd., is being used in an increasing number of instances where size and weight are all-important. An International Conference of the licencees of the Yardney International Corporation which controls the world patents on this form of silver-zinc accumulator is being held in London during March, and will be attended by licensees from Great Britain, the United States, France, Sweden and Germany.

Television Transmitters Order

The B.B.C. has placed orders with Marconi's Wireless Telegraph Co., Ltd., for the supply of three pairs of medium-power vision and sound transmitters for stock. The vision transmitters will have an output power of 5 kW and the sound transmitters 2 kW. They are generally similar in design and construction to those already in use for stand-by purposes at the post-war television stations.

Traders and Purchase Tax

Last week the report was published of the Committee on Tax-Paid Stocks (Stationery Office, 1s 9d). The Committee makes a three-part recommendation which it says should be regarded as a whole. The proposals are (*a*) that compensation should not be paid to traders in

respect of tax-paid stocks on their hands when purchase tax is reduced; (*b*) that traders should not be prevented from selling existing stocks at a higher price when the tax is increased; and (*c*) that no additional tax should be charged on stocks of goods on which purchase tax or duty has been paid when the rates of tax or duty are increased. The Committee considers that large and frequent changes in purchase tax on important classes of goods should be avoided and that relatively moderate changes should be made at the time of the Budget.

Iron and Steel Prices

The Minister of Supply has made an Order authorizing increases in the maximum prices of iron and steel. This follows the recommendation of the Iron and Steel Corporation of Great Britain that prices should be increased to take account of the recent rise in the price of coal. The effect of the Order, which came into operation on 14th March, will be to raise maximum prices by an average of between 1 per cent and 1½ per cent.

Dry Battery Price Reduction

The Association of Radio Battery Manufacturers states that the easement in the costs of raw materials, particularly of zinc, has made it possible to reduce by approximately 10 per cent the prices of all radio dry batteries. As an example the popular 120 V battery has been reduced from 19s 1d to 17s 1d inclusive of purchase tax.

Belgian Television Contract

It is announced that Pye, Ltd., has secured the contract for supplying equipment for two complete TV studios for the Institut National Belge de Radiodiffusion (I.N.R.), the Belgian television service. The total value is £70,000. Many concerns, including some from Germany, Holland, France and America, competed for the Belgian order. One of the outstanding features of this equipment is that it will operate on both 819 and 625 line systems, only a switch being necessary for the change-over. It is claimed that this equipment will be the only one of its kind in operation anywhere in the world. Test transmissions are due to commence in the autumn of this year.

Lighting for Fashion Parades

Berkertex, Ltd., of New Bond Street, London, held a series of fashion parades at the Northumberland Baths Hall, Newcastle-on-Tyne, on Monday and Tuesday last. Thorn Electrical Industries, Ltd., provided the whole of the lighting. Except for a small amount of "accent" lighting from "Atlas" tungsten filament spotlights, colour fluorescent display lighting was used throughout. The stage was illuminated by three-colour fluorescent lighting units while the walk was divided into three sections each with its own lighting units. As the model proceeded along the walk, the lighting was "faded in" by progressive stages, concentrating attention on the model. At the same time the colour of the lighting was adjusted to produce the right hue for the particular garments on display. All the lighting was controlled from a small panel on which miniature switches controlled motorized dimmers and colour mixing units behind the stage.

Codes of Practice for Buildings

The Council for Codes of Practice, Construction and Engineering Services, has now published eighty-six codes in final form. The total price of these codes is £16 18s 6d but the publishers, the British Standards Institution, 24, Victoria Street, London, S.W.1, will supply on demand the complete set of documents at the special price of £12 for the set, post free. This reduced price is subject to revision as further final codes are published.

Showcards and Signs

On Monday of last week the London office and showrooms of the Acme Showcard & Sign Co., Ltd., were officially opened at 9, South Molton Street, London, W.1 (Mayfair 0292). On view were signs and displays of all descriptions, including many colourful electrically illuminated models, flashing signs and several making use of "Black-lite." Samples of cases and cabinets for electronic instruments,

Corner in the new London showroom of the Acme Showcard & Sign Co., Ltd.

transformer tanks, instrument panels, etc., were also shown by Sign & Metal Industries, Ltd., a subsidiary company of Acme. The company has a staff of technical representatives covering the whole country and in addition to its factories at Enfield it also has showrooms at Birmingham.

Winston Electronics

Winston Electronics, Ltd., of Hampton Hill, Middlesex, announce the opening of a new transformer division. This is the result of an amalgamation between this company and the Edlin Electrical Co. Most of the Winston transformers have been made by Edlins and this new arrangement means that Winstons will be the sole distributors. Ranges already in production go up to 300 kVA oil-filled and include arc-welding, furnace, rectification, and regulation types. Production of C-core transformers will start in the near future. Mr. J. W. Binsted has been appointed sales manager of the new transformer division. He has been associated with the company for many years. All enquiries for these transformers should in future be addressed to Winston Electronics, Ltd., 1, Park Road, Hampton Hill, Middx.

Restrictions on Chinese Trade

On Monday last the Minister of Transport laid before Parliament the Control of Trade by Sea (China and North Korea) Order which prescribes that no British ship of 500 gross tons or more may operate to Chinese or North Korean ports without a licence. At the same time a list of prohibited imports to these countries has been compiled; it includes electric motors and generators, other electrical and electronic equipment and radio, telegraph and telephone apparatus.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £166 0s 0d
COPPER, H.C. Electro	ton £285 0s 0d
Fire Refined 99·70 per cent ..	ton £282 10s 0d
Fire Refined 99·50 per cent ..	ton £274 0s 0d
COPPER Tubes	lb 2s 8½d
Sheet	ton £338 10s 0d
H.C. wire and strip	ton £317 15s 0d
LEAD, English	ton £91 15s 0d
Foreign	ton £90 10s 0d
MERCURY	flask £70 10s 0d
TIN	ton £950 0s 0d
ZINC, G.O.B. Foreign	ton £79 5s 0d
Electrolytic	ton £83 0s 0d
BRASS Tubes	lb 2s 1¾d
Sheet	ton £266 15s 0d
Wire	lb 2s 7¾d
PHOSPHOR BRONZE	
Wire	lb 4s 1¾d
RUBBER, No. 1 R.S.S. spot ..	lb 21¾d–21¾d

Trade Announcements

The **London Electric Wire Co. and Smiths, Ltd.**, and its associate companies, Frederick Smith & Co., the Liverpool Electric Cable Co., Ltd., and the Vactite Wire Co., Ltd., announce the opening of a branch office and store at 7a, Young Street, Edinburgh.

The address of the Belfast office of **James Kilpatrick & Son, Ltd.**, is now 75, Great Victoria Street, Belfast, and new stores have been opened at 2-6, Norwood Street, Belfast.

The sales division of **Kenwood Electrics, Ltd.**, is now at the company's London premises at 26, North Audley Street, W.1 (telephone : Grosvenor 8411). All inquiries and correspondence regarding service and accounts should still be addressed to the works at Woking.

Catalogues and Lists

Bowser, Monks & Whitehouse, Ltd., 45a, Market Place, Doncaster.—Leaflet announcing the production of " U-Blanks "—standardized tool steel die blanks.

Chapman-Parker (London), Ltd., Rear Buildings, 266, Mitcham Road, London, S.W.17.—Illustrated leaflet announcing the new cat's-eye " Cord-Lite " switch cord protector.

Foster Transformers, Ltd., South Wimbledon, London, S.W.19.—New editions of pages for the Foster catalogue.

Simplex Electric Co., Ltd., Broadwell, Oldbury, Birmingham.—New specification folder dealing with fluorescent lighting fittings (L.1933).

Crompton Parkinson, Ltd., Crompton House, Aldwych, London, W.C.2.—32-page catalogue illustrating a wide range of meters and instruments for educational purposes and a Coronation display lighting catalogue.

Information Department

THE extensive records of our Information Department enable us to reply to most queries, but occasionally we ask our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

" Arco " electric fans.

Agents or suppliers of " Lumby " motor blowers.

General inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by the Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

THE MEXICAN MARKET

THE geographical proximity of the United States and its long-established cultural penetration of Mexico, together with the post-war economic difficulties of Europe, are the main reasons for American predominance in the Mexican market. In his report on the economic and commercial conditions in Mexico (H.M. Stationery Office, 3s 8d post free), Mr. R. G. Stone, Counsellor (Commercial), H.M. Embassy, Mexico City, says that in 1949 over 78 per cent and in 1950 over 86 per cent of Mexican exports were to the United States, while in the same two years nearly 87 per cent and more than 84 per cent respectively of Mexican imports were from America. Imports from the United Kingdom in 1950 totalled 2·29 per cent.

During the war imports from the United Kingdom naturally fell and in 1944 reached their lowest figure of 17 million pesos, as compared with 20 million pesos in 1938. Since the end of the war, however, imports from this country have risen rapidly and reached 101 million pesos in 1950. About two-thirds of the imports from the United Kingdom came under the headings of industrial materials and capital goods. The impact of rearmament in this country will make it increasingly difficult to supply Mexico with goods under these headings and Mr. Stone states that for the period in which the effects of rearmament will be most severe it is vital that an even greater effort should be made to increase the United Kingdom's share in Mexican imports of consumer goods. Every effort should be made towards local assembly of articles in this group which includes refrigerators, radio and television sets, washing machines, electric tools and household appliances, as the Mexican tariff gives ample protection against the import of finished articles.

There is a wide and growing demand for public works equipment of all types and already many United Kingdom concerns are supplying generators, switchgear, cables and test instruments, diesel and oil engines, and telephone equipment. A United Kingdom concern wishing to enter the Mexican market must as a rule look for an agent outside existing channels. Visits from principals at the outset are of advantage.

Referring to the electricity supply industry, the report states that the installed capacity of power plants in Mexico at September, 1951, amounted to 1,400,373 kW of which 50·37 per cent was hydro-electric, 35·98 per cent steam, 13·65 per cent diesel and other internal combustion engines. Industrial consumers absorbed 50·5 per cent of the total output, domestic consumers 14 per cent and commercial consumers 9·5 per cent. As about half the plant capacity is hydro-electric, periods of drought have from time to time brought about cuts in supply to industrial as well as domestic users. To meet this situation a nation-wide electrification project is being carried out with the aid of credits granted by the International Bank for Reconstruction and Development to the Federal Electricity Commission and the Mexico Light & Power Co., which have large power plants under construction. These include a 200,000 kW hydro-electric plant for supplying power to the Mexico City area and small steam plants which it is estimated will bring the country's installed capacity to 1,850,000 kW in 1955.

Commodity	1949		1950	
	Metric tons	Pesos (000)	Metric tons	Pesos (000)
Radio spares	141	14,322	135	16,587
Valves for radio receivers	129	6,698	129	8,693
Electric torches weighing up to 5 kg	91	2,321	119	3,797
Electric fans and ventilators	501	5,908	572	7,064
Electric lamp bulbs	—	—	157	2,168
Electric irons	28	481	69	1,641
Vacuum cleaners	47	1,091	73	1,551
Electric and gas lamps	45	827	101	1,332
Electric ovens and toasters	203	1,620	23	352
Radio receivers with cabinets	13	362	12	309
Electric generators, transformers, etc.	3,133	18,644	4,803	40,629
Electric motors	2,490	23,025	1,625	17,807
Telephone equipment	550	21,362	217	14,248
Electric switchgear	44	1,026	690	13,122
Apparatus, etc., not specified for electric conducting lines	488	7,813	543	9,618
Electric measuring apparatus	454	9,307	383	7,384
Wireless transmitting apparatus (units)	1,045	2,196	1,473	4,997
Electrical switchboards	44	1,027	147	2,946
Refrigerators	374	2,316	15	110

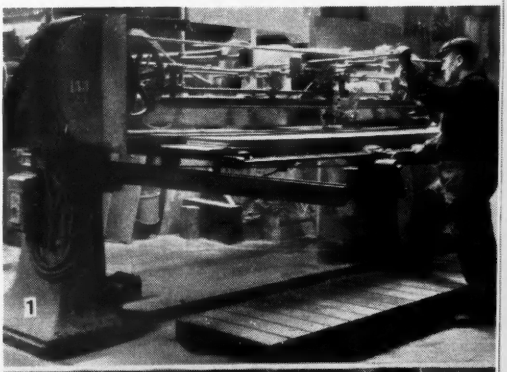
Modern Furniture Manufacture

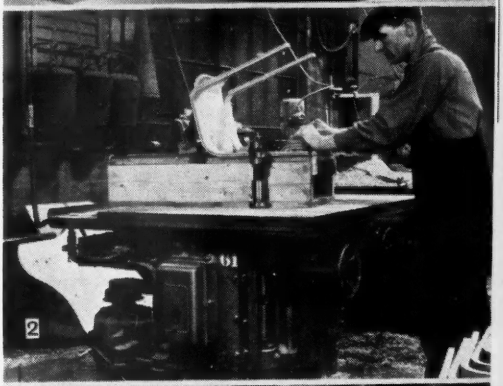
High Frequency Heating in Wood Welding

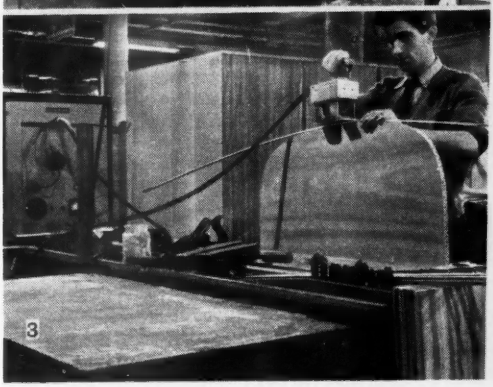
EVEN if it were to be disputed that many of the modern designs of furniture, particularly those involving the use of laminated wood, could not be produced without the use of electricity, there can be no doubt that manufacture is speeded up by the use of electrical appliances. H. Morris & Co., Ltd., Glasgow, are particularly receptive of new ideas and at their factory in Milton Street there can be seen a remarkable number of electrical aids to high-quality production. Some idea of the extent of electrification can be obtained from the fact that the maximum demand of the factory has now reached 260 kW, mostly taken by machines which individually require only a few kilowatts.

The steam heated drying kiln, in which the timber is seasoned before use, was one of the first with automatic control to be installed in the country. In this kiln the timber spends from one hour to four weeks at temperatures ranging from 50 to 145 deg F according to the type of wood and the condition in which it is received. Sometimes it is necessary to damp the outside of the wood, the spray used for this purpose as well as the steam being regulated by a Bristol's recorder-controller.

Waste chips of wood and shavings and sawdust from the manufacturing processes are used to fire the boilers producing the steam required for the kilns and for other process work. As a precaution against explosions a limit switch makes it impossible to open the damper while stoking is in progress.

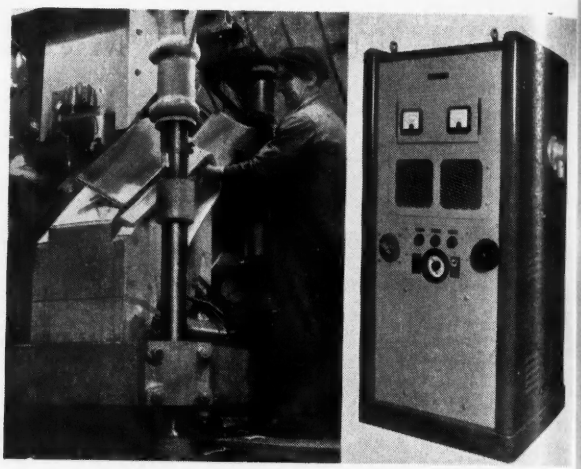






(1) This sanding machine which is adjustable for pressure and length of stroke is provided with fluorescent lighting to facilitate the detection of blemishes on the surface of the wood. (2) Spindle machine being used for dealing with the "Bambi" laminated chair. (3) High frequency wood welder in use for glueing a strip of wood to the headboard of a bed

Leaving the drying kilns, the wood is first cut to length by cross cut saws and then to width by rip saws, motors of about 5 h.p. being used in both cases with provision for speed variation from 750 to 3,000 r.p.m. The surfaces are then smoothed by various types of planes and surfacers for further treatment, as appropriate for the particular component, by circular and band saws, spindle moulders, double-end tenoners, mortisers, dovetailers, borers, routers, sanders and automatic nailing machines. Several of the machines incorporate more than one motor—some as many as fifteen—while where very high speeds are required, as in the case of routers, etc., frequency changers are employed to give up to 24,000 r.p.m.



Left: **"Bambi" laminated chair being removed from the press after curing by high frequency heating.** *Right:* **"Redifon" 6 kW radio frequency generator operating at 10 Mc/s**

Igranic "Lo-vo-lite" (12 V) lamps provide safe local lighting for the various machines. The high intensity and high quality illumination from fluorescent lamps is used over sanding and other machines and throughout the assembly and finishing departments to permit the rapid detection of blemishes.

Electric heating, both by conventional methods and also by high frequency, is extensively used in many glueing operations. Apart from the application of veneer to laminated board under heat and pressure, there is one particularly striking use, the tapeless jointing, in the matter of seconds, of the edges of two strips of veneer covered board. Small heating elements (2·5 kW) of the wire-wound type are employed in this case to heat the urea formaldehyde resin which is the adhesive medium in general use throughout the factory.

Radio frequency heating units are also employed for reducing the time taken to cure the glue in shaped laminated furniture. A particularly interesting example is to be seen in the manufacture of the novel "Bambi" chair. This is built up in a jig from a number of wood laminations coated with urea formaldehyde resin and placed between metal-faced wooden moulds, which are in turn accommodated in a power press, the assembly then being subjected to a pressure of 50 lb/sq in.

The radio frequency generated by a 6 kW "Redifon" heater which operates at 10 Mc/s is then applied. The resin is "cured" in from 3 to 5 minutes. The tuning coils are placed very closely around the load and are supported on the moulds; they can be adjusted to meet any capacity changes in the load caused by variations in the thickness of the wood or its moisture content.

Further applications of high frequency heating are encountered in the assembly and finishing departments where a number of wood welders is in use. Other electrical apparatus in these sections includes orbital sanders, cloth and rubber cutters, and sewing machines. Experiments are also in hand in the use of electrostatic painting and infra-red drying of finishes.

Apart from the above-mentioned production equipment, a comprehensive plant for the extraction of dust, etc., has been installed throughout the factory. It is in this installation that the largest motors in the factory are to be found, each of the four Keith Blackman fans being driven by a 40 h.p. Metrovick motor.

ELECTRICITY SUPPLY

Industrial Tariff Concession

Appliance Hire Resolution

TO assist depressed industries unable to reduce their maximum demand although using less electricity, the North Western Electricity Board announced last December that "ceiling" prices would apply until 31st March. It has now informed industrialists that despite the recent increase in coal prices it has been decided not only to extend the ceiling price concessions for another twelve months but to hold them at the same rates, namely 2d/kWh for the standard industrial monthly tariff "M," and 2½d/kWh for the standard industrial quarterly tariff "Q." In addition to assisting industries affected by adverse trade conditions, this concession will aid those with abnormal load characteristics and be of advantage to consumers during months or quarters in which holiday periods occur.

Another announcement by the Board of interest to industrialists is the decision to postpone for a further period of twelve months the application of the power factor clause under standard industrial tariffs. This is being done because some difficulty is still experienced in improving power factor owing to delays in the delivery of equipment, but the Board emphasizes that the concession will not be further extended.

Generation in February

The only major item of plant installed in British power stations in February was the first 52·5 MW Richardsons Westgarth turbo-alternator at the new Brighton "B" station. This brought the country's total plant capacity at the end of the month to 17,797 MW, including 560 MW in the North of Scotland Hydro-Electric Board's Area. Electricity generated during the month totalled 5,802 million kWh, an increase over the corresponding month of last year of 0·9 per cent compared with 4·6 per cent in January. The Ministry of Fuel and Power's statement now separates coke and breeze from coal and shows that greater use was made of this kind of fuel in February, while coal consumption decreased by 64,000 tons.

Call for Accounts Investigation

A strong protest against the fact that, as consumers' representatives, they had no power to do anything but accept additional charges "as and when the British Electricity Authority chose to impose them" was made by Mr. J. H. Sims-Hilditch, of Hastings, at a meeting of the South Eastern Electricity Consultative Council at Maidstone last week. He urged that an independent firm of auditors should be appointed to go into the accounts to see whether any reduction in expenditure could be made. "The consuming public are entitled to know and be satisfied that the electricity undertaking is being operated at the lowest possible figure, and they cannot know until the Consultative Councils have more power in their hands," he said.

Mr. D. C. Benn, of Hove, complained that every time a nationalized industry could not balance its budget it just put up its prices,

ELECTRICITY GENERATED AND PLANT INSTALLED

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total*		
British Electricity Authority ..	3,146	86	6·7	5,648	31	5,689	5,360	17,237
North of Scotland Board ..	20	1	1·2	29	79	113	112	560
Total for February, 1953 ..	3,166	87	7·9	5,677	110	5,802	5,472	17,797
Corresponding total for February, 1952	3,230	72	7·6	5,618	118	5,752	5,431	16,272
Increase or decrease, per cent ..	−2·0	+20·8	+3·9	+1·1	−6·8	+0·9	+0·8	+9·4
Total to date (2 months) ..	6,865	183	19·4	12,158	221	12,411	11,705	
Total for corresponding months of 1952	6,784	148	15·7	11,729	308	12,071	11,404	
Increase or decrease, per cent ..	+1·2	+23·6	+23·6	+3·7	−28·2	+2·8	+2·6	

*The total includes 10·7 million kWh generated by oil engines and 4·2 million kWh by waste heat plants in February, 1953.

and no one could do anything about it. The private firm had to find some other method of reducing costs to balance its budget. The stage was being reached where many people were cutting down their use of electricity because they could not afford to pay for it.

Mr. R. Norton, of Tonbridge, said that it was not only nationalized industry that was "passing the buck" to the consumer; everyone was doing it. It was no use attacking the South Eastern Electricity Board—the problem must be tackled from a national angle.

Points raised during the discussion are to be considered by a special sub-committee.

Payment by Stamps

At a meeting of the Yorkshire Electricity Consultative Council in Leeds last week a suggestion was approved that the Board should be asked to investigate the possibility of introducing stamps for the payment of electricity accounts. (A system of this kind is already in operation in the North Western Area.) Mr. S. Wade said that consumers would be able to buy stamps at short intervals and it might be that in some cases accounts would be paid before the electricity had been used. Mr. A. Bond, vice-chairman of the Board, said that if the Board was satisfied that the system was in the best interests of consumers it would be introduced, but if it was likely to cost money and only be of service to a very small number it would be necessary to think twice about it.

Electricity Supply Handbook

A new edition (the sixth) has been issued of the *Electrical Times* "Electricity Supply Handbook." The same general structure is retained but the matter has been revised and amplified, cognizance having been taken of changes in the organization of some of the Electricity Boards. The Handbook is published at 5s by the *Electrical Times*, Sardinia House, Sardinia Street, London, W.C.2.

Separate Welsh Board Opposed

After hearing the case for and against the establishment of a separate administration in Wales for the generation and distribution of electricity, Carmarthenshire County Council has decided not to support the proposal.

Mr. Wynne Samuel, speaking in favour of separation, contended that the industry was over-centralized in London and the Area Boards were far from being autonomous bodies. Since nationalization the South Wales Board had consistently declared surpluses. This money was not used to develop schemes for rural supplies in Wales; a substantial part went to subsidize the heavy losses sustained by English Boards.

Mr. Hadyn Lewis, a member of the South Wales Electricity Consultative Council, who spoke against the proposal, said that the people who would applaud separation would be those on Merseyside. The industrial areas of the Mersey now subsidizing rural North Wales would thus get rid of the unremunerative portion of the Area and the burden would be thrown on the small industrial belt of South Wales. He also pointed out that at present the main transmission lines ran from east to west and that the erection of new lines from north to south would be costly.

Bankside Gas-Washing Plant

Mr. I. J. Hayward, chairman, told the London Electricity Consultative Council last week that it was expected that the gas-washing plant at the new Bankside power station on the Thames would be near completion by the end of May. He said that up to the present the station had been used only at peak periods.

Hire of Appliances

The London Electricity Board is to be pressed by the Consultative Council to introduce, as soon as possible, a scheme for hiring apparatus to consumers, in addition to the existing system of hire purchase. A letter from the Board stated that the severe restrictions imposed on capital by both the former and present Governments had left no margin for investment in apparatus to be let on hire, but that the matter would again be considered in the coming financial year.

Gas to be Superseded

The South East Scotland Electricity Board has informed St. Andrews Town Council that the work of installing electricity in the 140 municipal houses in the town which are still lit by gas has been provisionally included in the programme for the year beginning 1st April.

Skipton Protest

Skipton Chamber of Trade is to protest to the National Chamber of Trade against the continually increasing cost of gas and electricity and also against the alleged waste of time and staff in the nationalized fuel and power undertakings.

Scottish Transmission Scheme

Mr. James Stuart, Secretary of State for Scotland, has confirmed a scheme for transmitting the electricity which will be produced by the Lawers and Breadalbane projects to the main grid. The estimated cost is £865,000.

Power Station Standards

In last week's leading article the thermal efficiency (on k Wh sent out) of Littlebrook "B" power station for the first six months of last year was printed incorrectly as 34·4 per cent; the figure should have been 30·04 per cent

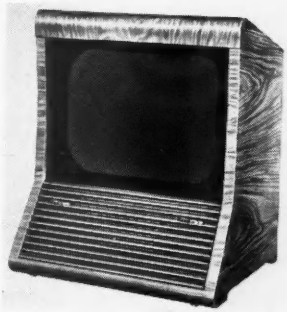
RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Automatic Picture Control

A TELEVISION receiver incorporating automatic picture control was demonstrated in London recently by PYE, LTD., Cambridge. In many television areas a certain amount of signal fading occurs; some places are worse than others but in many districts controls often have to be reset due to a change in signal strength. It is claimed that automatic picture control gives a steady picture of constant contrast and brilliance even though signal strength varies by as much as 10 : 1. This was convincingly proved at the demonstration and although the picture disappeared completely on an ordinary television receiver because of signal fading the automatic picture control set was not noticeably affected.

A further advantage with the new receiver is the "interference damper," a device which makes for a considerable reduction of "snow-storm" interference. In the bright areas of the picture streaks of interference stay white, but in dark areas they become grey and are practically invisible.



Pye television receiver incorporating automatic picture control

Tricolour Fluorescent Tube

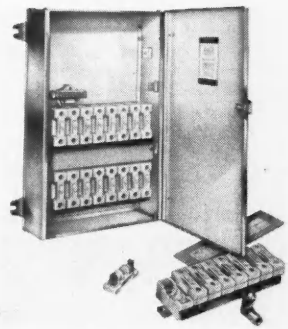
A 5ft 80 W red, white and blue "Osram" fluorescent tube has been introduced for the Coronation by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. The vivid colour scheme is obtained by applying special powders to the inside of the tube. There is no external colouring whatsoever and no deterioration of colour can occur during life. The tubes are available for switch or instant start and can be used in any existing fitting for 5ft tubes.

Light Industrial Fuseboards

Extreme lightness, without loss of rigidity or toughness, characterizes the new "Sandasteel" range of sheet steel fuseboards brought out by WM. SANDERS & CO. (WEDNESBURY), LTD., Falcon Electrical Works, Wednesbury. Despite compactness, the wiring is exceptionally easy with plenty of room to manœuvre the cables. The "Sandaspeed Duplex" fuses are arranged either to take h.r.c. or rewireable carriers, while neutrals, listed separately, can be fitted to suit individual requirements, thus considerably reducing the number of units that have to be stocked.

The boards are painted white inside with an easily cleaned steel grey stove enamel outside.

Eight-way 30 A triple pole "Sandasteel" fuseboard with neutral fitted



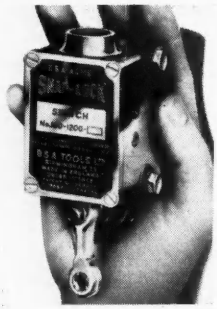
They are readily dismantled and packed for export. Hardwood fronts can be supplied for use where the unit is to be recessed in a wall.

At present only 30 A and 60 A models are available, but 15 A units will also be on the market shortly. A four-way 30 A t.p. and n. unit costs 130s 5d, and a six-way 60 A t.p. and n. board 340s.

Limit Switches

An agreement has been reached between B.S.A. Tools, Ltd., and the National Acme Company, Ohio, U.S.A., whereby "Snap-Lock"

limit switches will now be made in this country. Operations have already started and supplies of the standard-type limit switch should be available later this year. Principal features of these switches are quick and positive make and break action,



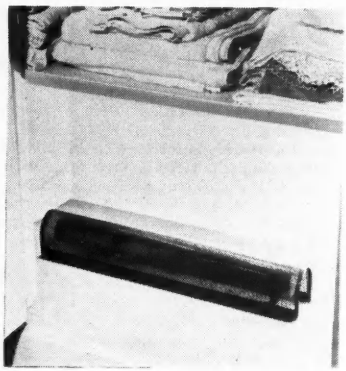
B.S.A. limit switch

by means of hardened steel knife-edge latches which ensure repetitive tripping, accurate to within 0·001in, separate enclosures for the mechanical and electrical units in a single housing, and resistance to water, oil and dust. The switch can be quickly adapted for single, double or distribution circuits and there are three optional mountings to suit users' requirements. The switches will be available for use on 220 V a.c. 10 A, 440 V a.c. 7·5 A, 125 V d.c. 5 A, and 125 V d.c. $\frac{1}{3}$ h.p. The sole selling agents in Great Britain are BURTON, GRIFFITHS & CO., LTD., Marston Green, Birmingham.

Airing Cupboard Heaters

Two wardrobe and airing cupboard heaters are introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2. One model, loaded at 120 W, provides a simple, cheap and effective means of converting any ordinary cupboard having slatted shelves into an airing cupboard. The other, loaded at 60 W, furnishes an equally simple means of preventing the ravages of damp and mildew in wardrobes or in food stores containing cereals, sugar, packeted foodstuffs and dry goods.

G.E.C. 120 W airing cupboard heater

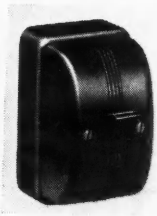


Arranged for screwing either to the base or wall of the cupboard each heater has a guard to prevent clothes, etc., from scorching. Both heaters and guards are painted with a matt dark brown heat resistant paint. The 60 W heater, which is 1ft in length, is priced at £2 0s 9d, while the 120 W heater (2ft) is £2 17s 1d, the prices including the guard and the purchase tax on the heater.

Compact Switches

A comprehensive range of Lundberg a.c. switches is offered by the SIMPLEX ELECTRIC CO., LTD., Broadwell, Oldbury, Birmingham, under the trade name "Miniac."

There are 5 A surface, flush, plaster depth and ceiling switches, bell push and push-push switches, plaster depth bell push switches, 15 A surface (a 30 A double-pole surface switch is also available) and flush switches, and 5, 13 and 15 A switch sockets.



"Miniac" surface switch with patress

The switches operate on the slow short break principle with the result that the size has been reduced to the minimum while maintaining maximum contact efficiency.

The mechanism is totally enclosed to exclude dust and moisture, and the range fully complies with B.S.1299 (Part 1). All "live" components are mounted on non-track mouldings of urea formaldehyde.

The single-pole and two-way flush switches can be mounted at 1in centres, thus making it possible to mount two in the space normally occupied by one. An adaptor plate is available to convert existing standard switch fittings. Two switches can be mounted in a B.S.1299 box, but if one of them is a two-way switch it should be mounted as the left-hand unit of the pair.

The double-pole and intermediate switches can be mounted at 1½in centres, thus affording a considerable saving of dimensions where multiple switch fittings are concerned, and the shallow depth, requiring only $\frac{9}{16}$in between the plate, provides additional wiring room for the cables. The standard finish of all the insulated switches is brown, with white as an alternative, available in finishes as listed in the new Lundberg price list (Publication No. LA.1975).

Ahead of Schedule

It is reported that the £6 million power station at Doncaster is likely to be completed in June, several months ahead of schedule.

Highland Water Power

North of Scotland Board's Report

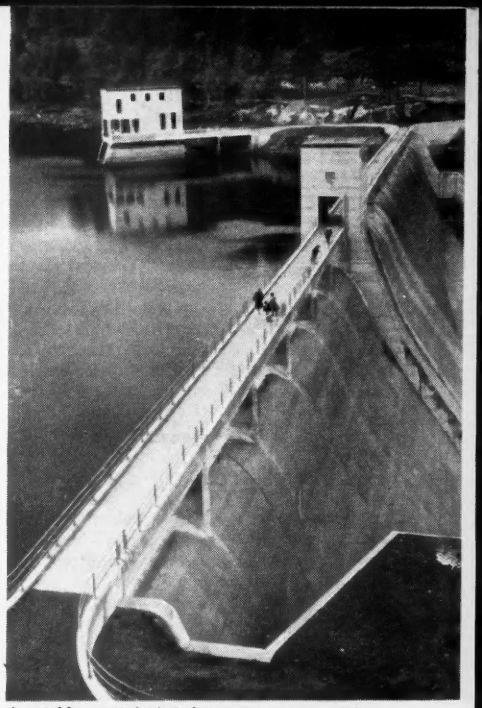
WATER power production in the North of Scotland Hydro-Electric Board's Area has about trebled in the last three years, and more than half the potential consumers who had no electricity in 1948 have now been connected. These facts are recorded in the Board's annual report for 1952 published last week (H.M. Stationery Office, price 2s 6d net), which also shows that the Board made a net profit of £4,929 on the year's working after meeting all operating costs together with interest and sinking fund chargeable against revenue. Capital expenditure during the year amounted to £13,616,015, making the total to date £82,744,393. The approximate population of the Area is 1,188,000, representing some 370,000 possible consumers. At 1st April, 1948, about 187,000 were connected and more than 96,000 have been added, leaving 87,000 to be connected. Most of those still awaiting a supply live in the more isolated parts of the country. The report asserts that the Board will do its utmost to link up rural consumers, in view of the importance of the agricultural industry, but some are too remote to have much prospect of getting a mains supply.

The capacity of the Board's hydro-electric stations is now 391·2 MW and production last year amounted to 889 million kWh. Table 1 shows how production has grown and summarizes prospective development.

Table 1.—Capacity and Output

	Capacity, MW	Annual Output, Million kWh
Already in operation:		
*1949	86·9	322
1950	284·7	522
1951	367·5	702
1952	391·2	889
Under construction	287	828
In course of promotion or survey	416	1,477
Total	1,094·2	3,194

*Production in 1949 was almost entirely from the Grampian Company's pre-war Rannoch and Tummel schemes.



A notable event during the year was the inauguration of the Mullardoch-Fasnakyle-Affric scheme by the Duke of Edinburgh on 13th October. The photograph shows the Benevean dam built into the gorge of the River Affric

The rate of hydro-electric production is now equivalent to an annual saving of nearly 600,000 tons of coal, the value of which, at a selling price of £4 5s a ton, is over £2,500,000.

About 75 per cent of the total production from water, steam and diesel oil was required for supply in the Board's own Area and about 25 per cent was exported to Central Scotland. The total demand of the consumers in the Board's Area reached a peak of 275 MW in December, 33 MW more than in 1951. In addition, the Board was able to meet a peak load from Central Scotland of 212 MW; this was 27 MW more than the figure of 185 MW for which the Board had contracted.

At the end of the year there were 6,200 workers employed on the Board's hydro-electric and other constructional works, a slight increase on the labour force at the end of 1951. The Board's employees engaged in the generation, distribution and transmission of electricity numbered 2,541.

Output of electricity from water power, steam and diesel stations aggregated 1,237

million kWh compared with 1,081 million in 1951. The average cost of hydro-electric power was 0·42d/kWh (some of the production was from pre-war power schemes built when constructional costs were much lower than to-day). The cost of production at the coal-fired power stations at Aberdeen and Dundee was 0·81d/kWh and at the diesel engine stations, 1·95d/kWh.

The steam stations of Dundee and Aberdeen generated 295 million kWh. It was often possible to shut down these stations at week-ends and carry the whole load on the hydro-electric stations. Some of the coal burned at Aberdeen was dross brought from the Brora coal-mine for which no local market exists. The Board's diesel power stations generated 52 million kWh last year.

Figures given in the report show the rising trend of distribution costs in the last four years (see Table 2). Capital expenditure on distribution last year amounted to £3,292,000. The Board is tackling the

Table 2.—Distribution Costs

Year	New Consumers	Cap. Exp. £ (000)	Average cost £
1949	18,797	1,911	102
1950	22,140	2,693	122
1951	18,861	2,863	152
1952	19,897	3,292	165

problem of rural distribution by comprehensive distribution schemes as well as by piecemeal extensions and work is starting on several new projects of this kind; the largest is the Strichen scheme which will provide electricity supplies to about 2,400 farms and 2,000 other houses in North-East Aberdeenshire.

During the year 128 villages, hamlets and housing areas were connected to the mains, including John o' Groats. Supplies to 10,274 consumers were changed over from d.c. to a.c. (making 53,000 since 1948). Altogether 1,051 million kWh was sold (against 916 million), including 304 (235) million to the B.E.A.

The 31 industrial consumers given a supply for the first time in 1952 included eight quarries and a shipyard at Montrose. Development of the farming load and extension of electrical methods on the farm were given special attention. It was possible to give 1,144 farms and 2,048 crofts a supply for the first time and one in every four of these in the Area is now receiving a supply compared with one farm in fourteen and one croft in a hundred in 1948.

Revenue in 1952 amounted to £6,580,581 (against £5,473,354 in 1951) and expenditure excluding capital charges to £3,110,714 (£2,290,395). Redemption fund appropriations and capital repayments absorbed £1,102,554 (£868,611) and interest and stock management expenses £2,008,160 (£1,421,784), leaving a net surplus of £4,929 (£16,520).

Because of increases in costs (including the rate of interest on capital) the Board was compelled to raise its charges for electricity by nearly 10 per cent in the autumn. Fortunately, the increasing use made of electricity has resulted in a spreading of the higher costs over larger numbers of kWh sold, so that the average price paid by consumers per kWh sold has risen by only 6 per cent since 1949, the figures being: 1949, 1·416d; 1950, 1·402d; 1951, 1·411d; and 1952, 1·498d. The Board's industrial consumers, unlike those in areas where fuel clauses operate, have enjoyed a stability in the price of electricity for eighteen months as the Board does not automatically increase its standard prices when there is an increase in the price of fuel.

The report states that experiments are in hand which may pave the way to running a gas turbine on pulverized peat. If success can be achieved in the economic burning of peat, of which 170,000 acres have been surveyed in the Highlands, the importance to the Highlands can hardly be exaggerated. The difficulties are considerable, principally because peat in its natural state contains 90 per cent or more of water. The technical problems of pulverizing and burning the peat once it has been dried have, however, already been largely overcome by John Brown & Co., of Clydebank, who have been carrying out researches sponsored by the Board for the Scottish Peat Development Committee. A 500 kW experimental gas turbine at Clydebank completed an endurance test of 1,000 hours' running on pulverized peat in November.

The Board continued to use local stone as far as possible in the building of power stations and substations. It has built or is building 16 generating stations of stone and 85 houses for the staff. As the result of the Board's encouragement, a quarry at T. in in Ross-shire is being re-opened and the

Torr Achilty power station in the valley of the River Conon is to be built of this stone.

The Board has been carrying out experiments with grass or hay cut early and dried by electricity and the results achieved at Ballindalloch (Banffshire), Nigg (Rossshire) and Braco (Perthshire) in 1952 showed considerable prospect of success.

The Board's experimental 100 kW wind generator at Costa Head in Orkney was given several test runs and as the result of the information gained work is now proceeding in preparing this wind generator for endurance trials and in designing a new machine of 250 kW.

The report gives in full the findings of the independent committee of prominent Scottish agriculturalists who investigated the effect on agriculture of hydro-electric development in Glen Affric and Glen Cannich and concluded that the operations of the Board on balance have saved agricultural land. Details are also given of fishery experiments.

Design Features of Scottish Schemes

TWO papers concerned with civil engineering aspects of the design of hydraulic features of hydro-electric works were presented at the 17th March ordinary meeting of the Institution of Civil Engineers in London.

It may be recalled that laboratory experiments were carried out to provide information for the design of two side-stream intakes for the Glen Affric works. Each intake consists of a siphon, the intake to the latter being submerged in a pond that is supplied with water by the side-streams. The pond was created by building a small dam, provided with a spill weir. The lower end of the siphon communicates with the tunnel, but a " vortex chamber " was interposed between the latter and the nozzle at the bottom of the siphon for the purpose of reducing high velocities before the water passes into the tunnel and for releasing air carried down during, or after, priming.

Because scale models of such devices may be misleading, Messrs. W. Eastwood, G. A. Taylor and Prof. Jack Allen described in their joint paper the precautions taken in the present instance to minimize the risk of errors resulting from possible misinterpretation of the experimental trials. The first section of their paper discussed various aspects of the Glen Affric siphons, the method of priming them, the discharges likely to result after priming and the pressures at various critical sections. The second part of the paper described the attempts made to determine the appropriate form and position of the exit from the vortex chambers, the sizes of those chambers and their effect upon the discharge of the siphons.

In another paper presented at the same meeting, Mr. C. M. Roberts described two features of the recently completed Affric scheme. Various possible designs for the Fasnakyle high-pressure water tunnel were investigated; the arrangement finally adopted was to divide the tunnel, each section being differently designed.

The upstream portion, under ample rock cover, consists of a single tunnel of circular section of 14ft 6in diameter lined with concrete and surrounded by a well-grouted rock zone. The downstream portion, under thinner rock cover, consists of three parallel steel pipelines, each of 8ft 8in diameter, laid in three tunnels and surrounded with concrete filling.

Detailed descriptions are given in this paper of the grouting procedure in the first case and of the method of making and testing circumferential joints in the second case.

After construction of the Mullardoch dam had started, the need to curtail capital expenditure made it necessary to alter the design to reduce the crest level of a part of it by 20ft. When the construction of the modified dam was nearing completion it was decided to revert to the full-height design. The raising of the crest level by 20ft involved both a thickening stage and a heightening stage. To minimize stresses from differential contraction between the old and new concrete in the former stage, the thickening concrete was added to the old dam in the form of a slab held separate from it by precast ribs and later joined to it by a filling of " Colcrete." Mr. Roberts also indicates in his paper the results of tests and observations made in connection with the dam raising.

European Electricity Supply

Forecast of the Position in 1956

TWO statistical reports with commentaries published by the Organization for European Economic Co-operation deal with electricity supply developments in the eighteen member countries, including the United Kingdom. The first (44 pages) relates to generating plant capacity and kWh production by public utility and industrial plants and consumption for various purposes in some countries, year by year from 1951 to 1956. The second document (32 pages) is concerned with fuel consumption in public supply generating stations between 1950 and 1956.

Plant Capacity and Output

From 1947 to 1952, the period covered by the European Recovery Programme, outputs of power stations (public and private) increased from 166,000 million to 270,000 million kWh (9 per cent per annum) and installed capacity from 47,000 to 72,000 MW (8·5 per cent per annum). From 1952 to 1956 the power requirements will, it is estimated, expand at an average yearly rate of 7 per cent, compared with a growth in energy output of 6 per cent and in installed capacity of 7 per cent.

Of the total production of 345,000 million kWh in 1956 (to meet requirements of 350,000 million kWh), 150,000 million kWh would be provided by hydraulic plants, containing 38,000 MW of the total of 92,000 MW. Water power will account for an increase of 11 per cent over the 1951 figures and thermal stations for about 16 per cent. The proportion of plant out of commission at peak loads is taken as about 13 per cent. Industrial generating plant accounts for one-eighth of the thermal and one-sixth of the hydro-electric capacity and produces nearly one-fifth of the total output.

A deficit in annual output, amounting to 7,400 million kWh in contiguous countries in 1956, is attributable to kWh shortages in Germany of 13 per cent, in Italy of 5 per cent and in the Netherlands of 2 per cent. Switzerland is expected to have a surplus of 25 per cent and Austria of 16 per cent. The French output and requirements should balance, provided median hydraulic conditions prevail, which have been assumed for the foregoing estimates.

Decline in European hydro-electric output of 15 to 20 per cent would mean a loss of from 22,000 million to 27,000 million kWh overall and considerably greater local percentage reductions. The equivalent combined deficit in effective capacity in a low-water year would be from 4,000 to 6,000 MW, against 1,900 MW under median hydraulic conditions, when peak capacities in Germany (13,000 MW) and in Italy (10,000 MW) would be respectively 2,000 MW and 1,600 MW less than their maximum demands.

Exports across frontiers have been consistently between 4 and 5 per cent of the total combined output of interconnected countries. This suggests the need for an additional thermal programme aggregating 5,000 MW to supplement the national projects now being planned.

Fuel Consumption

The fuel consumption report refers only to public supply stations, which generate 70 to 80 per cent of the electricity produced in thermal stations. The tonnage of hard coal burned (calorific value 10,000 to 13,500 B.Th.U./lb) is expected to rise from 53 million to 71 million, but whereas in 1950 it produced 86 per cent of the electricity generated the proportion in 1956 will have fallen to 81 per cent; lignite (c.v. 3,250 to 8,000 B.Th.U./lb) will be responsible for 11·5 instead of 7 per cent, and fuel oil (c.v. 17,300 to 18,700 B.Th.U./lb) for 3·6 per cent, the same as at present.

Average thermal efficiency of production from hard coal is expected to rise from 20·7 to 23·4 per cent, with the Netherlands (24·6) and the United Kingdom (24·5) still leading in 1956. For comparison it is stated that thermal efficiency in the United States is expected to increase from 25·4 to 26 per cent over the period under review.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

International Combustion (Holdings), Ltd.—The report and accounts for the year ended 30th September last, now issued, confirm the preliminary figures given in our issue of 6th March. In his review of the year which accompanies the report, Mr. G. R. T. Taylor (chairman) says that the total of unexecuted orders of the group, which includes many for overseas, is higher than it was at the corresponding time last year. With the present order book and the necessity for meeting the increasing universal demand for electrical power, he can see no immediate recession in the business. The group has successfully overcome the difficulties in connection with obtaining raw materials and other supplies, and the output constitutes a record. Their associated companies in South Africa, Australia and India continue to make good progress, as also do their subsidiary companies in this country. During the past year they registered a company in Pakistan in order to facilitate trading in that country. With regard to their associated Australian company, permission has been obtained for the transfer of the control of that company to Australia, which will be effected by the sale of part of their share-holding in that company, and arrangements will be made in due course to carry this out.

A. H. Hunt (Capacitors), Ltd.—The main figures in the accounts for 1952 were given in our issue of 27th February. In his statement, which accompanies the report and accounts now issued, Mr. S. H. Brewell (chairman) says that in spite of adverse conditions in some of the fields covered by their interests there was no deterioration in their overall export position during the year under review. The present level of manufacture is encouraging and plant and equipment has been kept up-to-date and efficient so far as the present heavy burden of taxation has permitted.

The Rheostatic Co., Ltd., reports a net profit for the year to 30th September last of £44,585, as compared with £37,742 for the preceding year. General reserve receives £21,500, and it is proposed to pay a final dividend of 15 per cent (against 12½ per cent), making 19 per cent for the year (16½ per cent). The balance carried forward is £6,194 (against £6,125 brought in).

G. D. Peters & Co., Ltd., report that after providing £100,500 for taxation, the net profit for 1952 is £86,976, as compared with £78,942 for 1951. It is proposed to pay a final dividend of 7½ per cent (same) and a bonus of 5 per cent (2½ per cent), making 20 per cent for the year (against 17½ per cent).

Electricity Board for Northern Ireland.—Particulars were advertised on Monday last, and the list opened and closed on Wednesday, of an issue of £2,000,000 Northern Ireland Electricity 4¼ per cent guaranteed stock, 1968-1971. The proceeds of the issue will be used for the repayment of existing short-term temporary borrowings already incurred and to meet further expenditure on the development of electricity generation and distribution.

New Companies

N. Pinnes, Ltd.—Registered 6th March. Capital £1,000. Electrical engineers and contractors, radio and television engineers, etc. Directors: N. Pinnes and Betty Pinnes. Regd. office: 36, Hillcourt Avenue, N.12.

H. C. Hiscock, Ltd.—Registered 9th March. Capital £5,000. Electrical engineers and contractors, etc. H. C. Hiscock is life and governing director. Regd. office: 55, Old Church Street, Chelsea, S.W.3.

Liquidation

Atozed (London), Ltd.—Particulars of claims by 27th March to the joint liquidator, Mr. A. W. S. Tabbenor, Kent House, Telegraph Street, London, E.C.2.

Bankruptcies

L. G. Sharp, 4, Summerley's Road, Princes Risborough, Bucks, electrician.—First and final dividend of 5s 6d in the £, payable on and after 25th March at 55, North Street, Thame, Oxon.

D. L. Smith, lately residing and carrying on business at Midland Bank Chambers, Cefn Road, Old Colwyn, Denbighshire, electrical engineer.—Last day for receiving proofs for dividend 30th March. Trustee, Mr. R. P. Booth, 5, Rumford Place, Liverpool, 3.

STOCKS and SHARES

INTERNATIONAL incidents checked effectively the rising level of activity and prices which has characterized Stock Exchange business since the start of the year. British Government stocks and industrial shares came back a little here and there, and there was a tendency for profits to be taken on speculative issues. The absence of any sharp or general reaction spoke well, however, for the underlying confidence developed in markets over the past few months. Caution would in any case be expected to increase with the approach of the Budget. Electrical equipment shares have turned a little irregular, but this section of the industrial market retains a firm appearance on the whole. Dealings began on Monday in Westinghouse Brake new ordinary shares, the price being 10s 6d premium on the 45s at which they are offered to shareholders.

Price Changes

Less favourable market conditions have failed to subdue the persistent buying of Reyrolle and C. A. Parsons shares, which have added another 2s 6d and 1s 3d respectively to previous big rises. Neither has there been a halt to the rise in Deccas, which has reached substantial proportions during the past month or so, on the strength of the company's annual accounts and report. B.I.C.C. and Telegraph Constructions both moved up 1s, and others to improve included Holophane, Hackbridge Cable and Southern Areas. Ericssons have been comparatively dull since the maintenance of the dividend at a total of 22 per cent tax free. A remarkable feature is the rise of 12s, within a fortnight, in Telephone Properties, on a revival of vague rumours about a purchase of the Venezuelan undertaking.

Dubilier Condenser

Among the electrical shares on offer recently in fair numbers were Dubilier Condenser 1s ordinary at 3s 7½d. This company's year ends with the current month. It is the practice to make a single annual payment; declared, last year, in July at the rate of 28 per cent. Subsequently, a small part of the company's substantial reserves were capitalized in the distribution of a 40 per cent share bonus. A proportionate reduction in the last dividend rate would scale this down to 20 per cent, on which basis the yield on the shares works out at 5½ per cent. As the last payment took only about one-seventh of the surplus profit, this is another case where it seems natural for the market to speculate on the chances of a repetition of the same rate as before on the larger capital. If this materialized, it would bring up the yield on the shares, at their present price, to 7¾ per cent.

Ekco Bonus

E. K. Cole 5s ordinary shares recently crossed the 20s mark for the first time for a year or more, the latest rise being a sequel to the company's recommendation of a one-for-six share bonus. This was announced with the declaration of an interim dividend of 10 per cent (the same rate as before) in respect of the financial year ending this month. It is remembered that the last capital bonus, a one-for-four distribution in 1951, was followed by the maintenance of the previous rate of dividend on the larger number of shares. Market opinion seems to look for the process to be repeated this time. Reference is made to the fact that last year's 25 per cent payment was covered by earnings equal to well over 100 per cent on the present capital, and to the evidence of satisfactory trading conditions in the radio and electronics world.

Dividends and Accounts

Rheostatic 5s ordinary shares were marked up to 9s 3d following the announcement of an increase in the final dividend, which makes a total of 19 per cent for the year ended last September, as compared with the 16½ per cent paid on the two previous occasions. The preliminary profits statement indicates a continuance of the upward trend in the company's earnings, and, consequently, a still substantial margin over the cost of the latest dividend. International Combustion's full accounts show an advance of over £300,000 (or 25 per cent) in the group trading surplus, and confirm the impression that the fall in net profits, announced earlier, was occasioned by a rise of no less than £391,000 in tax provisions: these take a total of £1·1 million and include £190,000 on account of the Excess Profits Levy, an amount considerably more, in itself, than the net sum received by ordinary shareholders in dividends.

N. Ireland Electricity Stock

Subscription lists opened on Wednesday of this week for £2 million Electricity Board of Northern Ireland 4¼ per cent stock, 1968/71, at 99. This is a full Trustee security, guaranteed by the Northern Ireland Government, and likely, other things being equal, to be well received. There is a distinct dearth of gilt-edged stocks which give the holder a present yield of well over 4 per cent, coupled with capital safeguards in the shape of fixed dates for the repayment of the principal, at par, within a not unduly long term of years. This issue comes up for comparison—approximately and not unfavourably—with the 4¼ per cent British Electricity stock, redeemable 1974/79, which is quoted in the market at 100.

ELECTRICAL INVESTMENTS

Past Week's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price 16th Mar. 1953	Week's Rise or Fall	Est. Yield £ s d
Gilt-edged and Overseas Stocks					
Brit. Elec. 1968/73	3	3	85½	—	3 10 2
Brit. Elec. 1974/77	3	3	84½	—	3 11 0
Brit. Elec. 1976/79	3½	3½	91	−½	3 17 0
Brit. Elec. 1974/79	4¼	4¼	100	—	4 5 0
Calcutta Elec. ..	6†	6†	20/-	—	6 0 0†
East African Power	7	7	23/6	—	5 19 3
Nigerian Elec. ..	10	10	23/-	—	8 11 0
Palestine Elec. "A"	5†	Nil	13/-	−6d	—
Perak Hydro-Elec.	Nil	Nil	15/-	..	Nil
Equipment and Manufacturing					
AberdareCables(5/-)	20	25	16/-	−6d	7 16 3
Aerialite (1/-) ..	83⅓	88⅓	9/6	—	9 6 0
Allen, W. H. ..	15	15	43/9	—	—
Aron Elec. Ord. ..	15	15	38/9	—	7 14 10
Assoc. Elec. Ord..	20	20	80/-	+ 1/16	5 0 0
Automatic Tel. & El.	15	15	62/9	−3d	4 15 6
Babcock & Wilcox	18	18	72/-	—	5 0 0
Baldwin, H. J. (2/-)	25	20	4/-	—	10 0 0
Bakelite (10/-) ..	—	12½	18/3	—	6 17 3
British Aluminium	10	12	42/6	—	5 13 0
B.I. Callender's ..	7½	9	36/3	+1/-	4 19 4
British Thermostat (5/-)	30	30	34/-	+9d	4 8 3
British Vac. Cleaner (5/-)	25	25	15/6	—	8 1 3
Brook Motors (10/-)	20	20	35/9	+9d	5 12 0
Brush Ord. (5/-) ..	10	10	5/-	—	10 0 0
A. F. Bulzin (1/-)..	30	30	3/-	+1¼d	10 0 0
Burco (5/-) ..	38⅔	35	19/6	—	8 19 6
Chloride El. Storage	15	15	72/-	+1/6	4 3 4
Cole, E. K. (5/-) ..	25	25*	20/6	—	6 2 0
Cossor, A. C. (5/-)..	Nil	10	10/9	−3d	4 13 0
Crabtree (10/-) ..	17½	17½	31/9	—	5 10 3
Crompton Parkinson Ord. (5/-) ..	11¼	11¼	9/6	—	5 18 5
De La Rue (5/-) ..	50	35*	8/-	−9d	—
Decca (1/-) ..	112½	150	26/6	+1/-	5 13 3
Dewhurst (2/-) ..	22½	19*	5 3	—	7 4 9
Dictograph Tel. (2/-)	20	20	6/-	—	6 13 4
E.M.I. (10/-) ..	12	12	14/6	—	8 5 6
Electrical Components (5/-) ..	20	20	10/-	—	10 0 0
Elec. Construction	15	15	56/3	+ 1/16	5 6 8
Enfield Cable Ord.	7½	7½	21/-	−6d	7 2 10
English Electric ..	15	15	58/9	—	5 2 3
Ericsson Tel. (5/-)	22†	22*†	41/6	−1/-	2 13 0†
Ever Ready (5/-)..	35	35	27/6	—	6 7 3
Falk Stadelmann..	15	15	42/9	—	7 0 3
G.E.C. Ord. ..	22½	22½	43/-	−6d	5 4 7
General Cables (5/-)	30	30	16/3	—	9 4 6
Greenwood & Batley	15	15	40/-	+1/9	7 10 0
Hackbridge Cable (5/-)	20	20	12/3	+6d	8 3 4
Hackbridge Hewittic (5/-)	18	20	16/3	—	6 3 0
Hall Tel. Acc. (10/-)	10	10	9/6	—	10 10 6
Heatrae (2/-) ..	12½	12½	4/-	—	6 5 0
Henleys (10/-) ..	20	20	18/3	−3d	5 9 7*
Holophane (5/-) ..	15	20*	12/6	+6d	8 0 0
Hoover (5/-) ..	25	25	22/3	—	5 12 4
Equipment and Manufacturing (continued)					
Intl. Combustion (5/-)	25	15*	13/3	—	5 13 3
Johnson & Phillips	15	15	58/3	—	5 3 0
Lancashire Dynamo	22½	12½*	45/9	—	5 9 3
Laurence, Scott (5/-)	12½	15	13/9	—	5 9 1
London Elec. Wire	12½	12½	58/3	− 1/16	4 5 7
J. Lucas	7½	9⅛	40/-	—	4 11 8
Marryat & S. (2/-)	22½	22½	5/-	—	9 0 0
Mather & Platt ..	12½	15	49/-	—	6 2 6
Metal Industries ..	10	15	45/9	—	—
Mid. Elec. Mfg. ..	15	15	60/9	+ 1/16	4 18 9
Murex	12½	15	60/-	—	5 0 0
Newman Ind. (2/-)	6	10	2/9	—	7 5 6
Oldham & Son (1/-)	30	35	2/6	−3d	—
Parnall (Yate) (5/-)	6	6	3/3	−1½d	9 4 7
Parsons, C. A. ..	15	10*	71/3	+ 1/16	—
Plessey (5/-) ..	22½	25	24/-	+9d	5 4 2
Pye Deferred (5/-)	18	18	17/3	—	5 4 4
Revo (10/-) ..	27½	27½	46/-	—	5 19 7
Reyrolle	15	10*	60/-	+ 1/8	—
Scot. Cable (4/-) ..	30	32	12/6	—	—
Siemens Ord. ..	10	10	36/6	—	5 9 6
Southern Areas ..	Nil	5	13/3	+6d	7 11 0
Strand Elec. (5/-)..	17½	17½	10/6	− 1/16	8 6 8
Sturtevant (5/-) ..	16½†	17¼*†	24/6	—	—
Switchgear&Cowans (5/-)	22½	22½	16/-	—	7 0 8
Taylor T. (5/-) ..	20	25	20/-	−6d	6 5 0
T.C.C. (10/-) ..	20	20*	38/-	—	—
T.C. & M. ..	10	10	29/-	+1/-	—
Telephone Mfg. (5/-)	10	10	9/3	—	5 8 0
Thorn. Elec. (5/-)..	10	12½	10/-	+6d	6 5 0
Tube Investments	25	15*	62/6	—	4 16 0
Vactric (5/-) ..	Nil	Nil	5/-	+6d	Nil
Veritys (5/-) ..	Nil	7½	5/-	—	7 10 0
Walsall Conduits (4/-)	70	70	46/6	—	—
Ward & Goldstone (5/-)	45	45*	32/6	—	—
Watford (2/-) ..	25	25	7/-	—	7 2 10
Westinghouse Brake	14	15	55/-xr	—	—
West, Allen (5/-) ..	12½	15	12/-	—	6 5 0
Trusts, Transport and Communications					
Anglo-Am. Tel.: A Ord.	—	6	83	—	7 1 6
Ord.	—	3¾	51½	—	6 17 6
Anglo-Portuguese	8	8	22/-	+6d	7 5 6
Brit. Elec. Traction: Def. Ord. ..	22½	25	500	—	5 0 0
Cable & Wireless: Ord.	6	8	127½	+2	6 5 6
4% Loan ..	4	4	94½	—	4 4 9
Calcutta Trams ..	6†	6†	22/3	—	5 7 9†
Cape Elec. Trams..	5	5½	11/6	+6d	9 11 4
Marconi Marine ..	10	10	31/-	—	6 9 0
Oriental Tel. Ord.	16	16	61/-	+1/-	—
Telephone Props..	8	8	45/9	+1/6	4 7 4
Tele. Rentals (5/-)	10	10	9/3	—	5 8 1

* After capital bonus.
† Dividends are paid free of Income Tax.

NEXT WEEK'S EVENTS

Monday, 23rd March

BIRMINGHAM.—James Watt Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Radio Group. "Electronic Motor Control," by S. H. Dale.

BRISTOL.—Electricity House, Colston Avenue, 6 p.m. I.E.E. Western Utilization Group. "Electricity in Farm Crop-Drying," by C. A. Cameron Brown and P. G. Finn-Kelcey.

ENFIELD.—George Hotel, 7.30 p.m. Purchasing Officers' Association, North London Branch. "The Legal Aspects of Purchasing," by J. M. Grammer.

LEICESTER.—E.M.E.B. Demonstration Theatre, Charles Street, 6.30 p.m. I.E.S. Leicester Centre. Display Lighting for the Coronation.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Radio Section. Debate: "That Broadcasting Hours should be Drastically Curtailed."

Caxton Hall, S.W.1, 7.0 p.m. E.P.E.A. London Technical Group. "275 kV Grid Development."

NEWCASTLE-UPON-TYNE.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North-Eastern Centre. "Post-Graduate Activities in Electrical Engineering," by W. J. Gibbs, D. Edmundson, R. G. A. Dimmick and G. S. C. Lucas.

Monday, 23rd March, to Friday, 27th March

LONDON.—New Horticultural Halls, Westminster. Factory Equipment Exhibition.

Tuesday, 24th March

BRADFORD.—Technical College, Great Horton Road, 6.30 p.m. I.E.E. North Midland Education Discussion Circle. Discussion on "Armature Windings," opened by E. M. Price and W. Lindley.

DUBLIN.—Mansion House, 8 p.m. I.E.E. Irish Branch. Faraday Lecture. "Light from the Dark Ages, or the Evolution of Electricity Supply," by A. R. Cooper.

LIVERPOOL.—Electricity Board's Service Centre, Whitechapel, 6 p.m. I.E.S. Liverpool Centre. "Lighting in Shipyards," by J. S. McCulloch.

LONDON.—Savoy Place, W.C.2, 7 p.m. I.E.E. London Students' Section. Address by the President, Col. B. H. Leeson.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Supply Group. "The Electrolytic Analogue in the Design of High-Voltage Power Transformers," by D. McDonald.

NOTTINGHAM.—Gas Department Demonstration Theatre, 6.30 p.m. I.E.E. East Midland Centre. "Some Modern Problems in the Field of Technical Education," by Dr. D. S. Anderson. (Joint meeting with the East Midlands Branch of the Institution of Mechanical Engineers.)

RUGBY.—College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre. Annual general meeting. Discussion on "Electric Traction."

WOLVERHAMPTON.—Staffordshire Technical College, Wulfruna Street, 7.15 p.m. British Institution of Radio Engineers, West Midland Section. "The Principles of Electronic Computing Machines," by Dr. B. V. Bowden.

WORCESTER.—Works Institute, Hylton Road Power Station, 7.15 p.m. I.E.E. South Midland Centre, Worcester and Malvern district meeting. "The Development and Design of Electrical Control Gear for Machine Tools," by A. R. H. Thorne.

YORK.—Creamery Restaurant, Pavement, 7.30 p.m. A.S.E.E. York Branch. "Installation and Maintenance of Electric Motors," by R. Spence.

Wednesday, 25th March

BLACKPOOL.—N.W.E.B. Demonstration Theatre, 45, Talbot Road, 7 p.m. I.E.E. North Lancashire Sub-Centre. "Electricity in Farm Crop-Drying," by C. A. Cameron Brown and P. G. Finn-Kelcey.

EDINBURGH.—Heriot-Watt College, 7 p.m. I.E.E. South-East Scotland Sub-Centre. "The Application of Transductors as Relays to Protective Gear," by R. K. Edgley and F. L. Hamilton.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply and Measurements Sections. "Transformer-Analogue Network Analysers," by M. W. Humphrey Davies and Dr. G. R. Slemon. (Joint meeting.)

2, Savoy Hill, W.C.2, 6 p.m. Illuminating Engineering Society. Informal meeting. Series of short papers by student members.

MIDDLESBROUGH.—Cleveland Scientific and Technical Institute, Corporation Road, 6.30 p.m. I.E.E. Tees-Side Sub-Centre, Students' Section. "High Voltage D.C. Transmission," by C. G. Hopper and B. D. Ripley.

OXFORD.—Assembly Room, Town Hall, 7.30 p.m. I.E.E. district meeting. "Nuclear Reactors and their Applications," by Sir John Cockcroft. (Admission by ticket only.)

PORTSMOUTH.—46, Commercial Road, 6.30 p.m. I.E.E. Southern Centre. "Some Aspects of Generating Station Construction," by C. W. Priest. (Joint meeting with Southern Branch of the Institution of Mechanical Engineers.)

RUGBY.—College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Students' Section. "Excitation Control of Synchronous Motors on Power Systems," by J. MacTaggart.

STAFFORD.—At the English Electric Co., 7.15 p.m. I.E.E. South Midland Students' Section. "Machines, Animals and Information," by B. Z. de Ferranti.

Wednesday, 25th March, to Saturday, 28th March

LONDON.—Earls Court. A.S.E.E. Electrical Engineers' Exhibition.

Thursday, 26th March

BRADFORD.—45–53, Sunbridge Road, 7.30 p.m. I.E.S. Bradford Group. "Fluorescent Forum."

BRISTOL.—Electricity House, Colston Avenue, 7.15 p.m. E.P.E.A. South Western Technical Group. Annual general meeting and film show: "The Electron Microscope," "Job—Pluto," "The Aerojet Circuit Breaker" and "Linesmen over the Thames."

LONDON.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers. Extra meeting. "Studies of Telephone Traffic with the Aid of a Machine," by S. W. Broadhurst and A. T. Harmston.

Waldorf Hotel, Aldwych, 6.45 p.m. Institution of Works Managers, London Branch. Paper by Sir Charles Bartlett.

MANCHESTER.—Engineers' Club, Albert Square, 7.30 p.m. Institution of Engineering Inspection, North-Western Branch. "A Rational System of Nomenclature in Ferrous Metallography," by Dr. P. Cranston.

Friday, 27th March

LONDON.—Savoy Place, 6 p.m. I.E.E. Education Discussion Circle. Discussion on "Special Features of Courses in Electrical Engineering in the Royal Navy," opened by Capt. (L.) L. S. Bennett.

Townsend House, Greycoat Place, 7 p.m. Junior Institution of Engineers. "Copying Lathes," by S. J. Downes.

MANCHESTER.—Engineers' Club, Albert Square, 6.45 p.m. Manchester Association of Engineers. Annual general meeting. "Friction between Solid Bodies," by Dr. R. Schnurmann.

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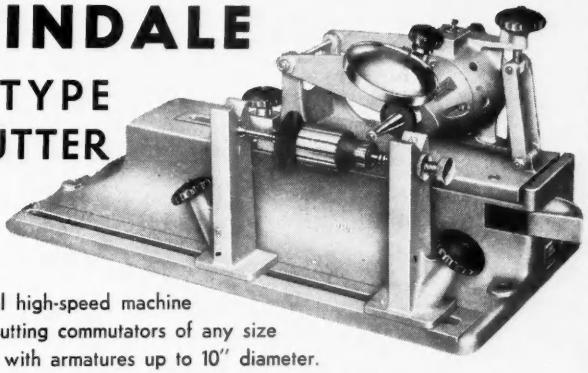

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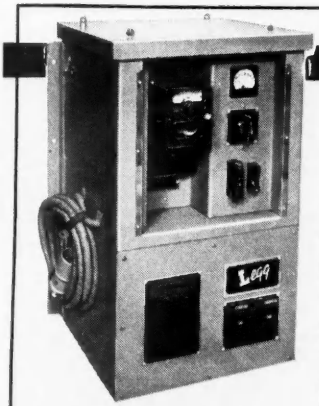

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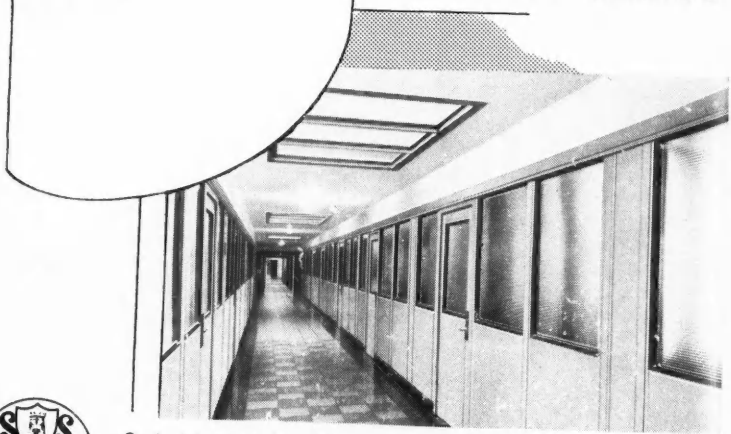

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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 29th April, from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1948

1905. Union Totalisator Co., Ltd., and Handley, J.—Electric totalizator systems. 21st January, 1949. (690681.)

3056. Eastern Electricity Board, and Golds, L. B. S.—Mechanical integrating mechanisms. 2nd February, 1949. (690801.)

13573. Soc. Anon. des Manufactures des Glaces et Produits Chimiques de St.-Gobain, Chauny, et Cirey.—Electrical conductors for use in contact with molten materials such as molten glass. 19th May, 1948. (690802.)

20040. General Electric Co., Ltd., and Espley, D. C.—Electric filter systems. 1st July, 1949. (690684.)

1949

3984. Mullard Radio Valve Co., Ltd., and Hutchinson, H.—Electric-discharge devices. 14th February, 1949. (690733.)

7299. Strong, H. V., and Eisler, P.—Manufacture of coated strip material for use in making electric circuit components or printed circuits. 16th March, 1950. (690696.)

7336. Houdry, E. J.—Process of generating power involving catalytic oxidation. 17th March, 1949. (690804.)

7601. British Electric Meters, Ltd., Batt, F. H., and Wrigley, S.—Brake-magnets for electricity meters. 10th January, 1950. (690923.)

10650. General Electric Co., Ltd., Cox, W. R., and Thompson, W. G.—Electric current converting arrangements. 24th April, 1950. (690734.)

18163. General Electric Co., Ltd., and Scott, P.—Ward-Leonard motor control systems. 10th July, 1950. (690928.)

20190. Compagnie des Freins & Signaux Westinghouse.—Ultra-high-frequency assemblies employing crystals of the asymmetrical conductivity type. 3rd August, 1949. (690735.)

27782. Strong, H. V., and Eisler, P.—Electrical resistors and printed circuits. 25th October, 1950. (690691.)

28111. Abbey, A. (Soc. de Constructions Mecano-Thermiques).—Power generating plants. 2nd November, 1949. (690739.)

30601. British Thomson-Houston Co., Ltd., Cox, H. E., and Dixon, C. J. E.—Electrical switches for heavy currents. 12th February, 1951. (690812.)

31017. Standard Telephones & Cables, Ltd.—Coating foil. 1st December, 1950. (690692.)

1950

135. General Electric Co., Ltd., Adams, O., Manners, M., and Partridge, J. H.—Immersion electrodes for the heating of electrically conducting liquids. 3rd January, 1951. (690693.)

1072. Hutchings, E. L.—Automatic stop mechanisms for electrically operated record reproducers. 19th February, 1951. (690817.)

4596. Parnall (Yate), Ltd.—Regulating apparatus for electrical heating systems. 22nd May, 1951. (690742.)

7758. Foster Wheeler, Ltd.—Steam power plants. 3rd May, 1951. (690708.)

8597. Henry & Thomas, Ltd., and Deakin, S. T.—Socket contacts for electrical plug and socket connectors. 4th July, 1951. (690743.)

8770. Tait, C.—Lighting systems. 6th April, 1951. (690744.)

12920. Widakowich, M.—Electric current convertors. 23rd May, 1950. (690826.)

13829. Murex Welding Processes, Ltd.—Method of surfacing metal articles by welding. 11th April, 1951. (690943.)

14237. Marconi's Wireless Telegraph Co., Ltd.—Cathode-ray tube deflection control systems. 23rd January, 1951. (690827.)

18327. Eastern Electricity Board, and Golds, L. B. S.—Mechanical integrating mechanisms. 2nd February, 1949. Divided out of 690801. (690830.)

22115. Siemens & Halske Akt.-Ges.—Electron valve having a luminescent screen. 7th September, 1950. (690756.) 22233. Electron valves having a luminescent screen, particularly to tuning indicator valves. 8th September, 1950. (690757.)

23065. British Thomson-Houston Co., Ltd.—Magneto generators. 20th September, 1950. Addition to 651223. (690712.)

25011. Midland Electric Manufacturing Co., Ltd.—Electrical switch or fuse boxes, junction boxes, and the like. 3rd September, 1951. (690952.)

25888. British Insulated Callender's Cables, Ltd.—Manufacture of electric cables. 23rd October, 1951. (690954.)

26680. British Thomson-Houston Co., Ltd.—Stabilization of polymerizable thixotropic compositions. 1st November, 1950. (690956.)

26971. Revo Electric Co., Ltd.—Cooking ovens. 5th November, 1951. (690957.)

28394. Pye, Ltd.—Combined television and sound system. 21st November, 1951. (690760.)

30483. Hunt, Ltd., A. H.—Electrical capacitors. 10th September, 1951. (690764.)

1951

229. Hackbridge & Hewittic Electric Co., Ltd., and Wells, R.—Apparatus for supplying the d.c. windings of a synchronous motor. 2nd January, 1952. (690964.)

563. Carr Fastener Co., Ltd.—Electrical plug or socket devices. 14th December, 1951. (690767.)

2920. British Insulated Callender's Cables, Ltd.—Electric measuring apparatus of the bridge type. 5th February, 1952. (690890.)

3923. General Motors Corporation.—Current-responsive thermally-tripped electrical switches. 19th February, 1951. (690772.)

7910. Maschinenfabrik Weingarten Akt.-Ges.—Control of electric motors for driving presses. 5th April, 1951. (690846.)

8673. Hazeltine Corporation.—Periodic-wave generator. 13th April, 1951. (690968.)

9485. Babcock & Wilcox, Ltd.—Tubulous natural circulation vapour generators. 24th April, 1951. (690969.)

10811. Waygood-Otis, Ltd.—Mechanism for controlling elevator circuits. 8th May, 1951. (690779.)

12912. Standard Telephones and Cables, Ltd.—Joining wires. 31st May, 1951. (690849.)

14031. Electric Terminal Corporation.—Machine for attaching metallic terminals to metallic wire. 13th June, 1951. (690782.)

19009. Leece-Neville Co.—Electrical generating machines. 13th August, 1951. (690979.)

19050. Whiting, J. G.—Light projector. 13th August, 1951. (690857.)

21086. Telecampliphone.—Two-way loudspeaker telephone installations. 6th September, 1951. (690720.)

22313. Akt.-Ges. Brown, Boveri & Cie.—Device for igniting single or multi-anode electric convertors of the mercury-pool type. 24th September, 1951. (690792.)

23516. Standard Oil Development Co.—Method and apparatus for operating a countercurrent vapour-liquid processing zone. 9th October, 1951. (690795.)

1952

556. Babcock & Wilcox, Ltd.—Cyclone furnaces. 8th January, 1952. (690912.)

882. Allmanna Svenska Elektriska Aktiebolag.—Frequency and phase convertor. 11th January, 1952. (690913.)

3385. Philips Electrical Industries, Ltd.—Rotatable aerial systems for use in radar apparatus. 8th February, 1952. (690915.)

3764. Des Roches, E.—Circuit testers. 13th February, 1952. (690919.)

Amended Specifications

601725. Standard Telephones & Cables, Ltd.—Direction and distance indicating system employing electromagnetic waves.

678427. British Tabulating Machine Co., Ltd., and others.—Electronic adding devices.

CANADIAN EXPORTS IN 1952

LAST year brought an increase of approximately 90 per cent in the value of Canadian exports of electrical apparatus. The total was nearly $34 million. The accompanying table shows the values of the principal groups with notes of increases or decreases on 1951. It will be seen that the only noteworthy decreases were in batteries and household appliances, while big advances took place in radio goods, power plant and insulated copper wire. The record of destinations testifies to the world-wide activities of Canadian exporters of electrical material.

Class of Equipment	1952 $ (000)	Inc. or dec. on 1951 $ (000)
Batteries, storage	346	− 304
To Ceylon	13	− 19
,, *South Africa*	13	− 35
,, *Israel*	21	+ 20
,, *Venezuela*	109	− 86
,, *Colombia*	69	+ 62
Batteries, other	545	− 720
To Malaya	167	− 602
,, *Ceylon*	130	− 42
,, *Indonesia*	153	+ 94
,, *Siam*	14	− 102
,, *United States*	41	+ 38
Radio receiving sets	1,454	+ 254
To Venezuela	153	− 166
,, *Indonesia*	117	+ 115
,, *Japan*	73	+ 58
,, *Siam*	47	− 8
,, *Pakistan*	62	+ 56
,, *Peru*	58	− 77
,, *Colombia*	163	+ 119
,, *Argentina*	78	+ 77
Radio apparatus, other	12,838	+ 10,585
To Italy	712	+ 707
,, *France*	968	+ 967
,, *United Kingdom*	2,273	+ 2,174
,, *Pakistan*	829	+ 827
,, *Norway*	267	+ 267
,, *Australia*	173	+ 161
,, *Venezuela*	181	+ 80
,, *United States*	6,101	+ 4,802
Dynamos, generators and parts	3,417	+ 2,373
To South Africa	21	+ 3
,, *Pakistan*	16	+ 1
,, *Australia*	175	+ 87
,, *Brazil*	2,888	+ 2,245
,, *Cuba*	41	+ 12
,, *French Africa*	29	+ 2
,, *Iraq*	13	+ 13
Telegraph and telephone apparatus	1,464	+ 589
To Brazil	121	− 55
,, *Australia*	344	+ 335
,, *France*	65	+ 63
,, *United States*	855	+ 232
Transformers and parts	4,294	+ 1,895
To Brazil	3,808	+ 1,476
,, *Mexico*	229	+ 229
,, *United States*	140	− 27
,, *Bolivia*	59	+ 58

Class of Equipment	1952 $ (000)	Inc. or dec. on 1951 $ (000)
Meters and parts	2,094	− 286
To Brazil	615	+ 5
,, *Chile*	162	− 46
,, *Colombia*	98	+ 10
,, *Cuba*	238	− 230
,, *Mexico*	519	+ 51
,, *Venezuela*	159	− 69
Spark plugs, magnetos, etc.	1,761	+ 167
Electrical apparatus, n.o.p.	3,618	+ 950
Cooking stoves, elec.	97	− 410
To United Kingdom	28	− 58
,, *Colombia*	14	− 16
,, *Peru*	15	+ 5
Cooking and heating devices, elec.	36	+ 13
Refrigerators (power) and parts	294	− 506
To Malaya	27	− 149
,, *Trinidad*	12	+ 3
,, *Turkey*	19	+ 9
,, *United States*	168	+ 97
Vacuum cleaners	29	− 9
To Mexico	15	− 3
Domestic washing machines, elec.	1,164	− 896
To South Africa	151	− 58
,, *Belgium*	169	− 98
,, *Mexico*	55	+ 18
,, *Peru*	57	+ 15
,, *Venezuela*	98	+ 55
,, *Switzerland*	134	− 166
,, *Brazil*	140	− 286
Copper wire, insulated	8,745	+ 5,696
To New Zealand	105	+ 77
,, *Arabia*	549	+ 545
,, *Colombia*	588	+ 493
,, *Cuba*	825	+ 771
,, *Dominican Republic*	158	+ 80
,, *Mexico*	178	− 307
,, *Peru*	813	+ 765
,, *Venezuela*	1,052	+ 159
,, *U.S.A.*	3,430	+ 2,589
Motors and parts	1,864	+ 635
To Mexico	117	+ 101
,, *Australia*	257	− 39
,, *New Zealand*	92	− 78
,, *Brazil*	128	− 9
,, *Colombia*	122	+ 109
,, *United Kingdom*	241	+ 155

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Amble (Northumberland).—U.D.C. Electrical installations in 26 houses to be erected on the Links estate. Surveyor, Council Offices.

Australia. — MELBOURNE. — 30th April. Deputy Director, Posts and Telegraphs. Supply of portable magnetic tape recorders. (C.R.E. 9371/53. Ten/5922.)*

Carlisle.—City Council. Electrical installations in 134 houses and also in the Harraby Junior School. City engineer, 18, Fisher Street.

Carmarthen.—30th March. County Council. Street lighting equipment. (See this issue.)

Gosforth (Northumberland). — 31st March. U.D.C. Supply and erection of equipment in connection with the provision of 93 street lighting units. Surveyor, Council Offices.

India.—NEW DELHI.—21st April. Director General of Supplies and Disposals. One 1,000 kW rectifier and three battery charging motor generating sets. (C.R.E. 9577/53. Ten/5930.)*

Kidsgrove. — 26th March. U.D.C. Provision of 38 reinforced concrete columns and 400 W mercury discharge lamps, and the removal of existing gas lamps and standards at the Avenue. O. Lloyd Hurst, clerk, Town Hall.

New Zealand.—WELLINGTON.—25th March. New Zealand Post Office. Supply of telephone cable. (C.R.E. 9117/53. Ten/5921.)* 28th April. Telephone cable. (C.R.E. 9118/53. Ten/5920.)* 30th April. P.v.c. cable. (C.R.E. 9119/53. Ten/5919.)*

Portuguese West Africa.—ANGOLA.—22nd April. Luarda Light and Water Supply Board. Supply of 32 km of armoured cable. (C.R.E. 8868/53. Ten/5903.)*

South Africa. — CAPE TOWN. — 6th May. City Electrical Engineer. Two transformers. (C.R.E. 9644/53. Ten/5933.)*

Southern Rhodesia. — SALISBURY. — Electricity Supply Commission. The call for tenders for power transformers reported in our issue of 6th March is for transformers up to and including 88 kV not 88 kW as stated.

Sutton Coldfield. — 3rd April. Borough Council. Supply and erection of 63 mercury discharge lamps on concrete columns and brackets (group A standard lighting), on the Chester Road. R. Walsh, town clerk, Council Offices.

Uruguay. — MONTEVIDEO. — 10th April. Administracion Nacional de Combustibles, Alcohol y Portland. Supply of four pumps, with electric motors and starters. (C.R.E. 9310/53. Ten/5925.)*

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

ORDERS PLACED

Alnwick.—R.D.C. Electrical installations in fifteen houses being erected at Embleton (£448).—N. Temple (Amble).

Blackpool.—Transport Committee. Recommended. Mercury arc rectifier, transformer, and switchgear equipment for Bispham substation (£15,890).—Hackbridge & Hewittic Electric Co., Ltd.

Durham.—County Council. Electrical work for new civil defence control centres at Billingham (£1,363) and Jarrow (£1,367). — Doves (Darlington), Ltd. Similar work at Felling civil defence control centre (£1,234).—A. F. Jemison (Newcastle-on-Tyne).

London.—STEPNEY.—Borough Council. Electrical installations in six blocks of flats (£5,439). —J. & W. Mayer. Installation of lifts in flats at Sidney Street (£2,289).—Express Lift Co., Ltd.

Sheffield.—Housing Committee. Electrical installations in 630 dwellings on the Hackenthorpe estate (£10,849).—Hobson & Scott, Ltd.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Belfast.—Development of estate in the Springfield Road area, with provision for 300 houses; housing architect, Chichester Street.

Birmingham. — Houses (76), at Heathy Farm, Bartley Green; first section of City of Birmingham Training College, Westbourne Road; first section of Aldridge Road Multitype School; extensions to Moseley Grammar School for Boys; grammar school for girls, Brook Lane, Billesley; and extensions to Hartfield Crescent Grammar School for Girls; H. J. Manzoni, city engineer.

Blackburn. — Dwellings, Eccleshill (30), Mellor (31), etc. for R.D.C.; engineer, 42, Wellington Street, Blackburn.

Blackpool.—Factory in Clifton Road; Blackpool Rope & Twine Co., Ltd., Clare Street.

Extensions for Lancashire Cash Bakery, Ltd.; J. Gregson & Son, Oxford Square, Marton, Blackpool.

Boldon (Durham).—Houses (82), Wellands estate; U.D.C. surveyor.

Cambridge. — Laboratories (£500,000), for University Senate; Kerridge (Cambridge), Ltd., builders, Sturton Street.

Cardiff.—Central omnibus station in Wood Street; borough surveyor.

Chadderton.—Houses, Arden Street site (24) and Scholes Street site (35); U.D.C. surveyor.

Chatham.—Library building with flats over, Walderslade Avenue; borough engineer.

Cheadle.—Grammar school; F. M. Parkes, county architect, Chester.

Colwyn Bay. — Houses (42), Glyn estate; T. Alun Hughes, Llanerch Road, Rhos-on-Sea, Colwyn Bay.

Corby.—Old people's houses, South Road Camp; U.D.C. architect.

Coulsdon and Purley.—Development of site in the Old Lodge Lane area, with provision for about 300 houses, shops, etc.; H. M. Collins, U.D.C. surveyor, Council Offices, Purley.

Cove (Hants). — County infants' school (£191,620); county architect, The Castle, Winchester.

Coventry. — Civic theatre, with shops, maisonnettes, etc., at corner of Corporation Street and Fretton Street (£180,050); D. E. E. Gibson, city architect, Bull Yard, Warwick Row.

Croydon.—Flats (174) and houses (16), Sylvan Hill; borough engineer.

Cumberland.—Additions to Millom Grammar School; county architect, 15, Portland Square, Carlisle.

Darlington. — Factory extensions; Skerne Works, Ltd., pulley manufacturers, Dodsworth Street.

Bus station; borough architect, Town Hall.

Doncaster.—Factory at Long Sandall industrial site; Smiths (Mineral Waters), Ltd.

Eastbourne.—Houses (142) and flats (78), Ocklynge site; borough engineer.

Laboratory and offices, Hampden Road, for C. Armour & Co., Ltd.; Walter Llewellyn & Sons, Ltd., 3, Cornfield Terrace.

Gateshead. — Factory additions for the Square Grip Reinforcement Co., Ltd.; Cordingley & McIntyre, architects, The College, Durham.

Storage building of 5,250 sq ft for H. Leverton & Co., Ltd.; Arthur & Kirkup, architects, 13, Swinburne Street, Gateshead.

Police houses (22); borough architect, Town Hall.

Gosport. — Houses (134), South Street; borough surveyor.

Grantham.—Houses (24); borough architect.

Horbury.—Police houses in Northfield Lane; West Riding county architect, Bishopgarth, Westfield Road, Wakefield.

Leicester.—Second stage of extensions to Eastfield Hall (estimated cost £18,925); city architect.

Liverpool. — Extensive business premises, offices, etc., Lord Street and Paradise Street, for Horne Bros., Ltd.; Hillier, Parker, May & Rowden, architects, Grosvenor Street, London, W.1.

London.—Bethnal Green.—Flats and maisonnettes at Shipton Street; Skinner, Bailey & Lubetkin, architects to B.C., 188, Piccadilly, W.1.

Euston. — Additions to premises, Fitzroy Square, W.1, for Frederick Tibbenham, Ltd. (£21,000); Hamilton & Partners, architects, 82, Portland Place, W.1.

Lambeth.—Flats (132) and houses (30), Rosendale Road; Gollins, Melvin, Ward & Partners, architects, 15, Manchester Square, W.1.

Mansfield.—Shops, with flats over, on the Ladybrook Lane housing estate; borough surveyor, Carr Bank.

Middlesex.—Boys' modern school, Enfield (£175,554), section of Pinner Park School, Harrow, school at Harlyn Drive, Northwood, additions and alterations to Kingsbury Grammar School, Wembley, and modern school at Crest Road, Willesden; Middlesex county architect, 10, Great George Street, S.W.1.

North Shields.—Factory, offices and warehouse, Bird Street for Scott & Son; J. R. Wallace, architect, 20, Northumberland Square, North Shields.

Poole.—Factory and office premises; Loewy Engineering Co., Ltd., Lindsay Road, Bournemouth.

Prudhoe (Northumberland). — Houses (660), West Wylam, for U.D.C.; J. M. Angus, architect, 21, Lovaine Place, Newcastle.

Sandy.—Fire station, Sandye Place (£8,259); county architect, Bedford.

South Kesteven.—Houses (20), Deeping St. James; R.D.C. architect, North Street, Bourne, Lincs.

South Shields.—Factory for the manufacture of building blocks in Commercial Road for A. J. Wares, Ltd., builders' merchants, King Street, South Shields.

Stanley (Co. Durham). — Houses (47), Annfield Plain; J. Routledge, surveyor, U.D.C. Offices.

Stockport.—R.C. school at Nangreave Road; Reynolds & Scott, architects, 9, Albert Square, Manchester.

Stoke-on-Trent. — Proposed museum and art gallery at Bell Pottery site; city architect.

Stretford.—Reconstruction of premises at Trafford Bar for Burkes, Ltd.; E. Levy, architect, 32, Deansgate, Manchester.

Sunderland. — Extensions to factory of Jackson Associated Manufacturers Co., Ltd., Villiers Street; Stephenson & Gillis, Saville Chambers, Saville Row, Newcastle-on-Tyne.

Thornaby-on-Tees. — Health centre and dental clinic; county architect, Northallerton.

Thrapston.—Houses (37), for R.D.C.; H. G. Kenyon, Council Offices, Midland Road, Thrapston, near Kettering.

Windsor.—Flats (56), in Clewer New Town; R. T. Chapelle, U.D.C. architect, Town Hall.

Wolverton.—Houses (38), Stacey Hill estate; surveyor, Market Square, Stoney Stratford.

Wood Green. — Section of new municipal buildings scheme; borough surveyor, Town Hall, N.22.